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THE CASEMENTS *Fig.* 7. VIEW BEFORE TEST.

Publications of the

BRITISH FIRE PREVENTION COMMITTEE.—No. 31.

Edited by Edwin O. Sachs.

FIRE TESTS WITH GLASS.

THREE CASEMENTS

GLAZED WITH

WIRED GLASS

BY

Messrs. PILKINGTON BROS., Ltd.,

ST. HELEN'S, LANCASHIRE, AND LONDON.

The Committee's Report.

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LONDON, 1899.

PUBLISHED AT THE OFFICES OF

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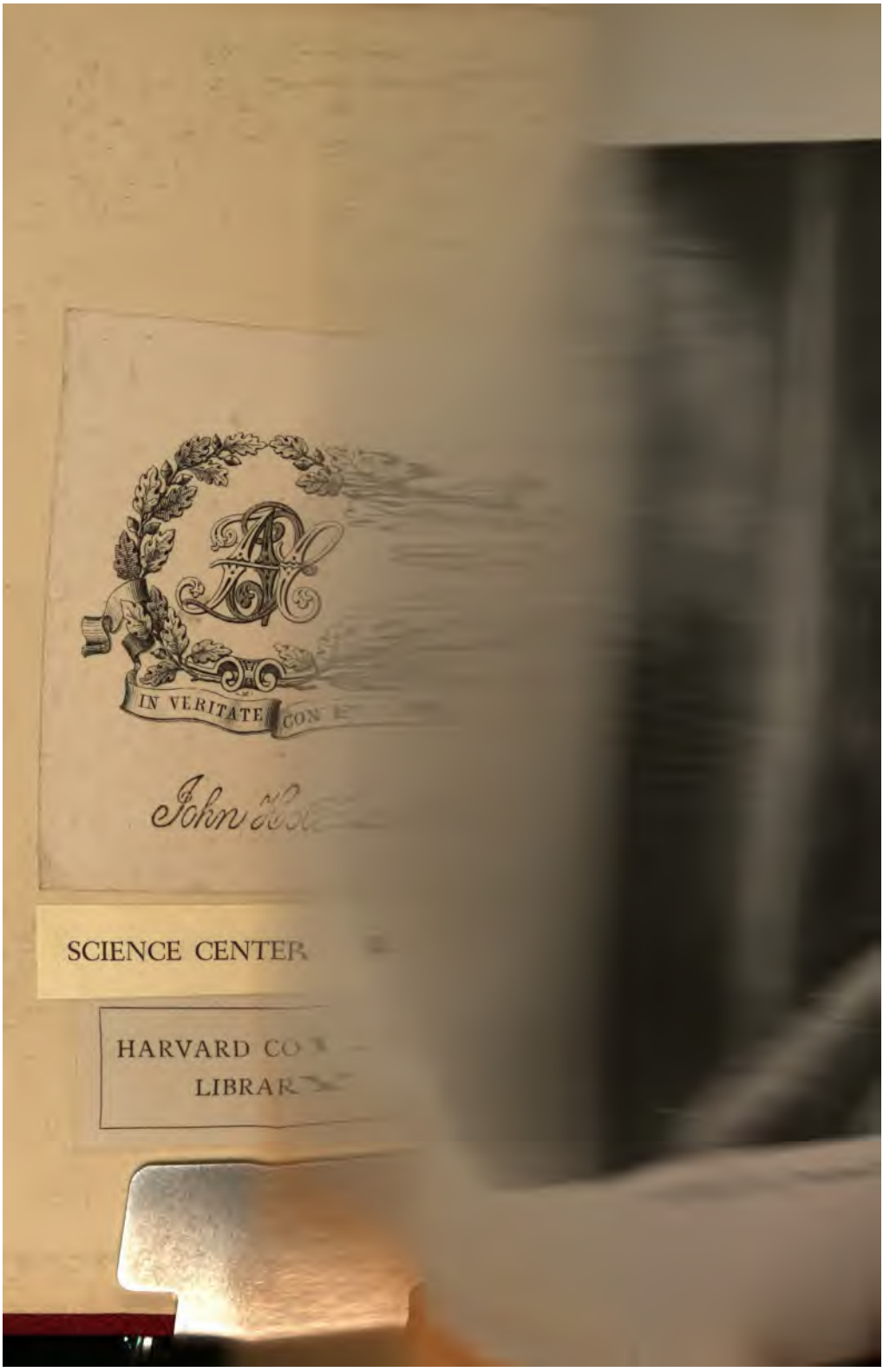
(Founded, 1897—Incorporated, 1899),

1, WATERLOO PLACE, PALL MALL.

Two Shillings and Sixpence.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OBJECTS OF THE COMMITTEE:

The main objects of the Committee are :—

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimising the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

To publish from time to time papers specially prepared for the Committee, together with records, extracts, and translations.

To undertake such independent investigations and tests of materials, methods and appliances as may be considered advisable.

The Committee's Reports on Tests with Materials, Methods of Construction, or Appliances are intended solely to state bare facts and occurrences, with tables, diagrams, or illustrations, and they are on no account to be read as expressions of opinion, criticisms, or comparisons.

NOTE.

This test belongs to the series of investigations with different forms of glazing. The various kinds of ordinary glass are being tried; further, the special forms of glazing as adapted to the ordinary glazing materials; and, lastly, as in this case, a special form of glass, known as "wired glass," is under examination.

As to the importance of the subject, I would only repeat that it is much underrated. The proper protection of the windows overlooking areas, shafts, etc., would only too often localize a fire.

With regard to the exact resistance of the material here tested, it is not my purpose to say anything, but to refer the student to the Committee's report.

EDWIN O. SACHS.

LONDON,

September, 24th, 1899.

THE GENERAL ARRANGEMENTS FOR TESTS.

(MEMORANDUM.)

The purpose of the tests undertaken by the British Fire Prevention Committee is to obtain reliable data as to the exact fire-resistance of the various materials, systems of construction, or appliances used in building practice.

The tests are of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability is assured, records being mostly taken automatically or by photography, and the temperatures being easily regulated by the application of gas.

All reports on tests solely state the bare facts and occurrences, with tables, diagrams and illustrations, and on no account are reports to include expressions of opinion, nor should any expression be read as a comparison or criticism.

The general arrangement and direction of the tests are in the hands of the Executive, who act in accordance with certain principles laid down after careful study and experiment. The official tests are attended by the members of the Council and the members of the Committee in rotation.

As to the Testing Station, it comprises two houses standing in their own grounds near Regent's Park, and backing on to the Regent's Canal. The principal building is used for Committee Rooms and laboratory purposes, whilst the gardens are utilised for so-called "full-size" tests.

As to the financial aspect of the station, the establishment expenses are being met by a special subscription. As far as the funds of the Committee permit, investigations and experimental tests with ordinary (*i.e.*, not patented) forms of construction are undertaken from time to time and duly reported on. Official tests with patented materials, makers' systems, etc., etc., are subject to a scale of charges, but these charges are so figured as to only just cover the actual cost. Any surplus is refunded. The Testing Station is also open to members for such private research work or tests they may desire to undertake.

The services of the members participating in the management of the station, conducting or attending tests, are given entirely gratuitously.

For the Executive,

EDWIN O. SACHS, *Chairman.*

OFFICIAL REPORTS

OF THE

British Fire Prevention Committee.

[FOUNDED 1897.—INCORPORATED 1899.]

FIRE TEST No. 11.—JULY 26TH, 1899.

CASEMENTS GLAZED

WITH

PILKINGTON'S WIRED GLASS.

OBJECT OF TEST.

To record the effect of fire and water upon Pilkington's wired glass in teak casements.

The duration of the Test was to be forty-five minutes. The temperature was to be gradually raised to 1800° Fahr. Water was to be turned on to the outside of the glass for a period of one minute at the expiration of 30 minutes, and at the expiration of 45 minutes water was to be again applied.

Note.—The casements, three in number, were each to show 2 ft. $9\frac{7}{8}$ in. by 3 ft. $11\frac{1}{2}$ in. of glazing in the clear.

SUMMARY OF EFFECT.

In one minute the glass commenced to crack in various directions, but no smoke or flame came through.

In two minutes smoke appeared through joints of teak casements.

In 28 minutes the outside of teak casements took fire.

In 30 minutes the glass in centre casement began to buckle and let the flames through.

In 34 minutes the glass in centre casement began to fuse and bend outwards.

In 37 minutes the glass in north casement began to fuse and bend inwards.

In 49 minutes the glass in south casement began to fuse and bend outwards.

The glass in casements was unbroken, but fused and doubled up into various shapes.

DESCRIPTION OF TESTING PLANT.

(*See Figs.* 1 *to* 4.)

The Testing Chamber was located at the Committee's Testing Station, and was a portion of "No. 1 Hut."

The chamber was constructed, as shown, of stock bricks with lime mortar, and measured 10 ft. by 5 ft. 9 in. internally.

The soffit of the hut was 7 ft. 6 in. above the pavement of the chamber. The roof of chamber was constructed of wood joists and beams placed side by side to make a solid soffit.

The door opening was on the south side, and measured 2 ft. 6 in. by 6 ft. 6 in.

The fuel used was gas produced at the station, and the supply was regulated by valves and dampers.

The gas was admitted through a mixing chamber of fire-brick on the east side, 10 ft. by 3 ft. super. as shown.

A Roberts-Austen pyrometer was used for recording temperatures, five observation records from points 1, 2, 3, 4, *i.e.*, three on the inside of the chamber, and two in passage-way.

There was one observation hole in the west wall covered by a sliding hatch.

The ventilation holes were in the west wall.

The photographs were partly taken by daylight and partly by flashlight.

The stream of water was applied through a branch with $\frac{1}{2}$-in. nozzle, equipped with a pressure gauge, and supplied from a manual fire engine similarly equipped.

The
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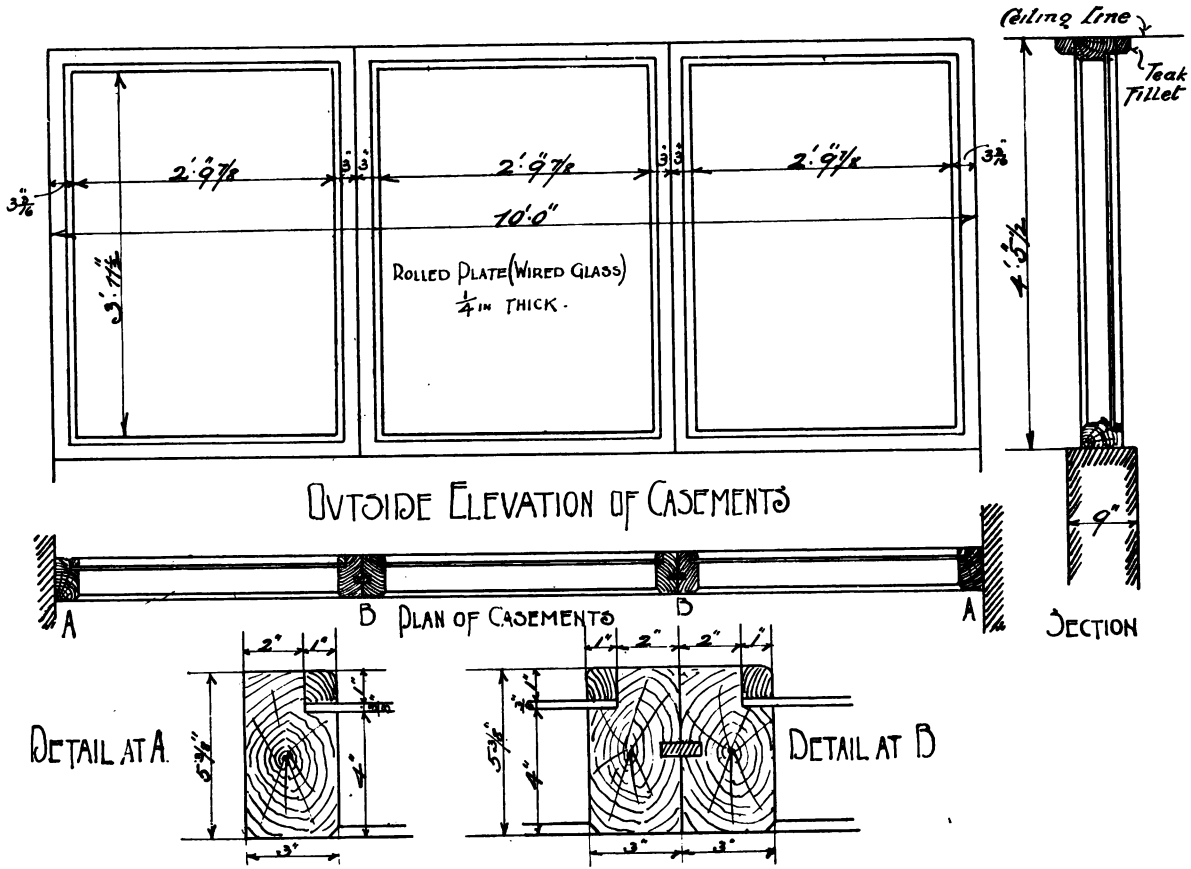


THE CASEMENTS. *Figs.* 5 AND 6. DETAILS.

A dwarf wall, 9 in. thick, 2 ft. 6 in. high, of fire-bricks and fire-clay, was erected across the hut in the position shown, so as to admit of entrance on the east or outside of the combustion chamber proper. The west side, or inside, served as the combustion chamber.

CONSTRUCTION OF THE CASEMENTS.

(See Figs. 5 to 8.)

A few days before the Test the casements were put into position.

A plan, two sections, and some details are shown. The fixing of the casements was carried out as follows:—

Upon the dwarf wall three teak rebated casements were fixed, reaching from the top of the dwarf wall to the soffit of the hut. The casements were tongued together, and teak fillets were fixed where the casements butted against the walls and the soffit of the hut.

The casements were glazed with Pilkington rolled plate wired glass, $\frac{1}{4}$ in. thick (*Figs. 5 to 7*) and fixed to the rebated teak frames by teak beads. Each casement showed glazing measuring 2 ft. $9\frac{7}{8}$ in. by 3 ft. $11\frac{1}{2}$ in.

THE TEST.

On Wednesday, July 26th, the Test was undertaken. The following is the log of the Test:—

At 3 p.m. the meteorological observations, taken at the Botanic Gardens, Regent's Park, read as follows:—

State of weather, cloudy, fine, warm; Rain, none; Wind, W.; Barometer, 30·19; Attached Thermometer, 75° Fahr.; Dry Bulb, 78·8° Fahr.; Wet Bulb, 66·8° Fahr.

At 3.37 p.m. the gas was turned on and the Test commenced.

From 3.37 p.m. till 4.17 p.m. the gas was gradually further turned on; the following temperatures were recorded from pyrometer points Nos. 1 to 4.

	Outside.		Inside.	
Time.	No. 1. Fahr.	No. 2. Fahr.	No. 3. Fahr.	No. 4. Fahr.
3.37 p.m.	—	—	1,050°	475°
3.42 „	—	—	1,365°	950°
3.47 „	160°	275°	1,400°	1,065°
3.52 „	335°	420°	1,600°	1,280°
3.57 „	440°	515°	1,700°	1,335°
4.2 „	500°	600°	1,550°	1,460°
4.7 „	1,250°	200°	1,615°	1,600°
4.12 „	725°	950°	1,715°	1,600°
4.17 „	1,440°	1,585°	1,760°	1,580°

At 3.39 p.m. the glass in the casements began to crack in various directions, but no smoke or flame came through.

At 3.46 p.m. smoke came through joints of teak casements.

At 4.6 p.m. the teak casement took fire on the outside all up styles and along head.

At 4.7 p.m. glass in the three casements bulged inwards.

At 4.8½ p.m. glass in centre casement buckled and let fire through.

At 4.8½ p.m. water was applied from outside for one minute.

At 4.12 p.m. glass in centre casement became partly fused and bent outwards.

At 4.14 p.m. glass in north casement began to fuse.

At 4.15 p.m. glass in north casement fused and bent inwards.

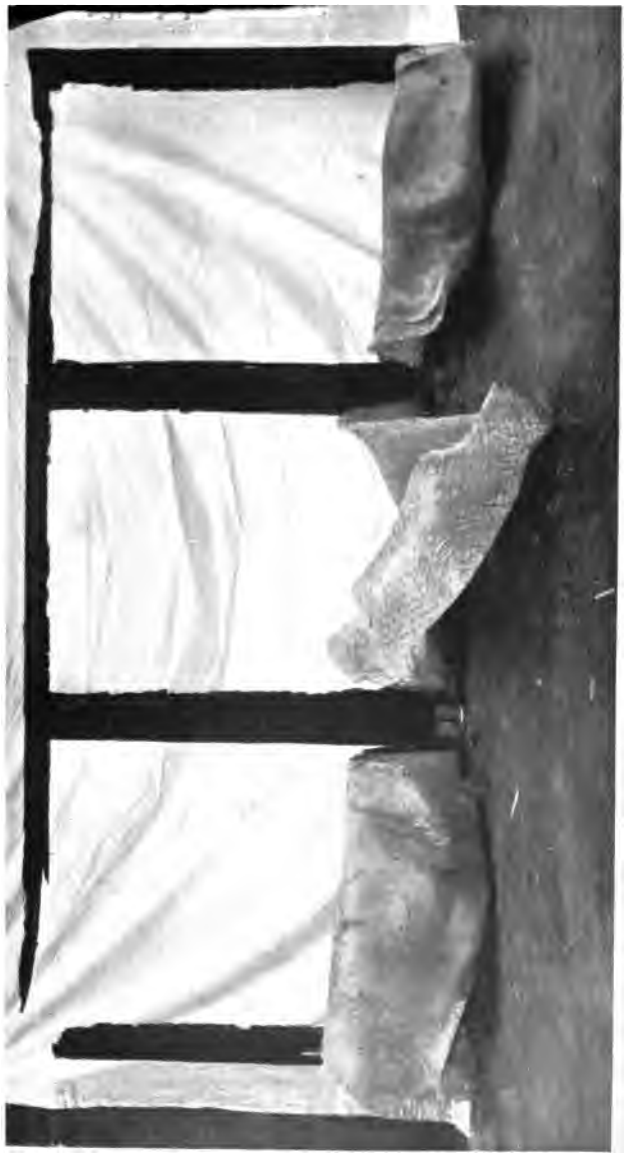
At 4.17 p.m. glass in south casement began to fuse.

At 4.19 p.m. glass in south casement fused and bent outwards.

At 4.20 p.m. the gas was turned down and water was applied from outside for two minutes.

THE CASEMENTS. *Fig.* 8. VIEW AFTER TEST (FROM OUTSIDE).

THE CASEMENTS. *Fig.* 9. VIEW AFTER REMOVAL (FROM INSIDE).



THE CASEMENTS. *Fig.* 10. VIEW AFTER REMOVAL (FROM OUTSIDE).

OBSERVATIONS AFTER TEST.

(See Figs. 8 to 10).

On July 27th photographs were taken (*see Figs.* 8 *to* 10).

The glass in casements was unbroken, but fused and doubled up into various shapes.

The whole of the teak casements were charred on both sides, the top rails and the upper part of styles being more severely damaged than the rest and the beads consumed.

GENERAL ARRANGEMENTS.

The Test was carried out in accordance with the procedure laid down by the Executive for investigations of this description, and conducted by a Sub-Committee of the Executive, comprising :—

Mr. Ellis Marsland, District Surveyor, Camberwell (Directing Member).

Mr. Max Clarke, A.R.I.B.A.

Mr. Robert Mond, M.A., F.R.S.E.

Mr. Thomas Kissack, Resident Engineer at the Testing Station) assisted the Sub-committee.

Mr. T. E. Leslie Alldridge (Royal Mint) superintended the instrument room.

The Council was represented by :-

Mr. Thomas Blashill, F.R.I.B.A., F.S.I., late Architect to the London County Council.

Sir John Taylor, K.C.B., H.M. Office of Works.

The Executive was represented by :—

Mr. Edwin O. Sachs (Chairman).

Mr. F. Hammond, F.R.I.B.A., District Surveyor, East Hampstead.

Mr. Edmund Woodthorpe, M.A., F.R.I.B.A., District Surveyor, Northern Division, City.

The Members' Testing Sub-committee was represented by :—

Mr. George E. Monckton, M.A.

The general body of members was represented by :—

Mr. S. Flint Clarkson, F.R.I.B.A., District Surveyor, Chelsea.

Mr. R. P. Notley, F.R.I.B.A., F.S.I., District Surveyor, Bethnal Green.
Mr. W. White, F.R.I.B.A., F.S.A.

Messrs. Pilkington were represented by:—
Messrs. W. Lee Pilkington, and D. W. Ames.

The following visitors attended by special invitation of the Executive:—

Admiral Sir H. H. Nicholson, K.C.B.
Mr. O. B. Leitch (Assistant Director of Works, Admiralty).
Mr. F. S. Capon (Factories and Workshops Branch, London County Council).
Major E. Palliser.
Captain G. McArthur, R.N.
Mr. J. F. Golding.
Mr. P. S. Greig.
Mr. H. Egan Hill (Messrs. Williamson, Hill & Co., Solicitors to the Committee).
Mr. E. Meyerstein.
Mr. J. D. O'Brien.
Mr. George Pritchard.

For the Sub-Committee conducting the Test:
ELLIS MARSLAND (*Directing Member*).

For the Commercial Section:
FREDERIC R. FARROW.

For the Executive:
EDWIN O. SACHS (*Chairman*).

Published by the Committee as directed by the Executive.

GEORGE E. MONCKTON
(Secretary).

Date-25th September, 1899.

Verified a true copy of the Report, ordered to be published.

WILLIAMSON, HILL & Co.
(Solicitors).

Date—3rd October, 1899.

THE SKYLIGHTS. *Fig.* 8. VIEW AFTER TEST.

Publications of the

BRITISH FIRE PREVENTION COMMITTEE.—No. 32.

Edited by Edwin O. Sachs.

FIRE TESTS WITH GLASS.

TWO SKYLIGHTS

GLAZED WITH

WIRED GLASS

BY

Messrs. PILKINGTON BROS., Ld.,

ST. HELENS, LANCASHIRE, AND LONDON.

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The main objects of the Committee are:—

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The Committee's Reports on Tests with Materials, Methods of Construction, or Appliances are intended solely to state bare facts and occurrences, with tables, diagrams, or illustrations, and they are on no account intended to read as expressions of opinion, criticisms, or comparisons.

NOTE.

The great importance of fire-resisting glazing cannot be underrated, and the application of fire-resisting glass is, as I have explained before, a matter calling for the attention of architects and engineers.

The protection of the ordinary window has been all too long neglected; but the skylight has had even less consideration from the expert. With a report before us such as the one here presented, there should, however, be no longer so much reason for this neglect; for we are now able to gauge the exact resistance of a skylight that has been dealt with in a specific manner from the fire point of view.

Of course we must, at the same time, still hope to have further opportunities of investigating the full extent of the fire resistance of this and similar forms of glazing; for only by comprehensive examination under varied circumstances will the necessary confidence be given to what are practically at present unknown means of protection. The more that is known about the various methods of fire-resisting glazing the better both for the owners of bricks and mortar and the general community.

EDWIN O. SACHS.

LONDON,
September 25th, 1899.

THE GENERAL ARRANGEMENTS FOR TESTS.

(MEMORANDUM.)

The purpose of the tests undertaken by the British Fire Prevention Committee is to obtain reliable data as to the exact fire-resistance of the various materials, systems of construction, or appliances used in building practice.

The tests are of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability is assured, records being mostly taken automatically, or by photography, and the temperatures being easily regulated by the application of gas.

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As to the financial aspect of the station, the establishment expenses are being met by a special subscription. As far as the funds of the Committee permit, investigations and experimental tests with ordinary (*i.e.*, not patented) forms of construction are undertaken from time to time and duly reported on. Official tests with patented materials, makers' systems, etc., etc., are subject to a scale of charges, but these charges are so figured as to only just cover the actual cost. Any surplus is refunded. The Testing Station is also open to members for such private research work or tests they may desire to undertake.

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For the Executive,

EDWIN O. SACHS, *Chairman.*

OFFICIAL REPORTS

OF THE

British Fire Prevention Committee.

[FOUNDED 1897.—INCORPORATED 1899].

FIRE TEST No. 12.—JULY 26TH, 1899.

SKYLIGHTS GLAZED

WITH

PILKINGTON'S WIRED GLASS.

OBJECT OF TEST.

To record the effect of fire and water upon Pilkington's wired glass in skylights.

The duration of the Test was to be 30 minutes. The temperature was to be gradually raised to 1500° Fahr. Water was to be turned on to the outside of the glass for a period of one minute at the expiration of 15 minutes, and at the expiration of 30 minutes water was to be again applied.

Note.—The skylights, two in number, each showed 2 ft. 6 in. by 4 ft. 7½ in. of glazing in the clear.

SUMMARY OF EFFECT.

In one minute the glass began to crack.

In three minutes smoke came through joints around frame and brickwork.

In fifteen minutes, on the application of water from the top, the glass bulged inwards some 2 in., but did not let the fire through, the water being retained in the hollow formed in the south skylight and gradually boiling away; that in the north light filtering through two small holes in the glass.

On the expiration of the 30 minutes, the glass was intact, except for the cracks, and the fire did not pass through it.

DESCRIPTION OF TESTING PLANT.

(See Figs. 1 to 4.)

The Testing Chamber was located at the Committee's Testing Station, and was a portion of "No. 1 Hut."

The chamber was constructed, as shown, of stock bricks with lime mortar, and measured 10 ft. by 3 ft. 6 in. internally.

The skylights were fixed on the top of the chamber. (*See plan.*)

The soffits of the skylights were 8 ft. 10 in. above the pavement of the chamber.

The fuel used was gas produced at the station, and the supply was regulated by valves and dampers.

The gas was admitted through a mixing chamber of fire-brick as shown.

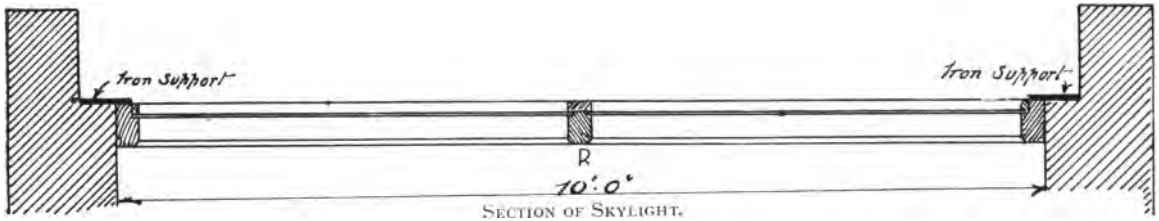
Two Roberts-Austen pyrometers were used for recording temperatures, to take four observation records from points 1, 2, 3, 4.

There was one observation hole in the east wall covered by a sliding hatch.

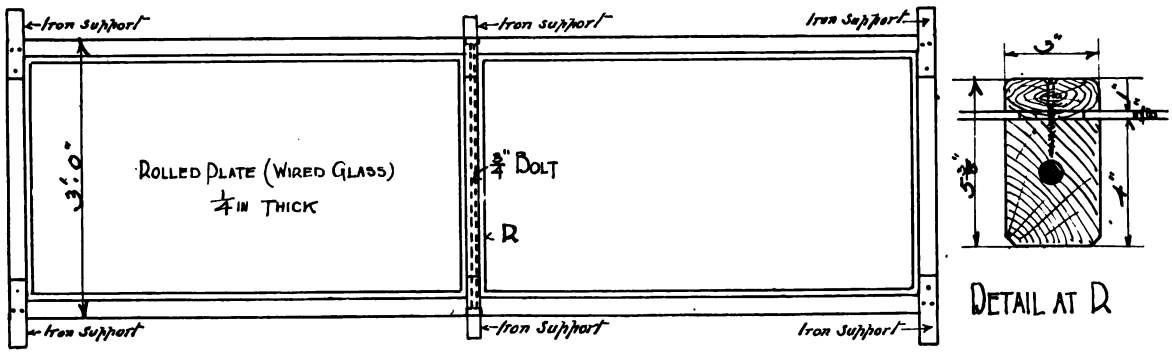
The ventilation holes were in the east wall.

The photographs were taken by daylight.

The stream of water was applied through a branch with ½-in. nozzle, equipped with a pressure gauge, and supplied from a manual fire engine similarly equipped.



SECTION OF SKYLIGHT.



PLAN OF SKYLIGHT.

DETAILS OF SKYLIGHTS, *Figs.* 5, 6.

Fig. 7. View before Test.

CONSTRUCTION OF THE SKYLIGHTS.

(See Figs. 1 to 7.)

A few days before the test the skylights were put into position.

A plan, sections, and some details are shown. The fixing of the skylights was carried out as follows :—

The skylights were glazed with Pilkington's rolled plate wired glass, ¼ in. thick, with teak skylight bars 4 in. by 3 in., and teak cover fillets on top, 3 in. by 1 in. (*see Figs.* 5 *and* 6). Each skylight showed glazing measuring 2 ft. 6 in. by 4 ft. 7½ in.

THE TEST.

On Wednesday, July 26th, the test was undertaken.

The following is the Log of the Test :—

Note.—At 3 p.m., the meteorological observations, taken at the Botanic Gardens, Regent's Park, read as follows :—

State of weather, cloudy, fine, warm ; Rain, none ; Wind, W. ; Barometer, 30·19 ; Attached Thermometer, 75° Fahr. ; Dry Bulb, 78·8° Fahr. ; Wet Bulb, 66·8° Fahr.

The following temperatures were taken from points Nos. 1, 2, 3, and 4 :—

OBSERVATIONS TAKEN AT POINTS NOS. 1, 2, 3, 4.

From 3.27 *p.m. to* 4.7 *p.m.*

HUT No. 1.

TIME.	No. 1. Fahr.	No. 2. Fahr.	No. 3. Fahr.	No. 4. Fahr
3.37 p.m.	665°	650°	525°	550°
3.42 „	1,100°	1,175°	880°	1,080°
3.47 „	1,160°	1,200°	965°	1,185°
3.52 „	1,175°	1,340°	1,050°	1,100°
3.57 „	1,175°	1,265°	980°	1,475°
4.2 „	1,275°	1,425°	1,160°	1,650°
4.7 „	1,075°	1,060°	775°	580°

At 3.36½ p.m. the gas was turned on.

At 3.37 p.m. the glass in both skylights began to crack.

At 3.39 p.m. smoke was seen to come through the joints around frame and brickwork.

At 3.51½ p.m. water was turned on to the upper surface of skylights at from 12 lbs. to 20 lbs. pressure for one minute. The glass bulged inwards.

At 3.52½ the water was turned off, and that which remained in the hollow of the south skylight boiled with the heat until dry. The water that remained in the north skylight drained away through two holes.

At 4.6½ p.m. the gas was turned off.

At 4.7½ p.m. water was again applied at about 20 lbs. pressure.

At 4.8½ p.m. the water was turned off.

The fire did not pass through the skylights.

This concluded the test.

OBSERVATIONS AFTER TEST.

(See Figs. 8 to 10.)

On July 27th photographs were taken (*see Figs.* 8, 9, and 10).

Water from the second application was still retained in the hollow formed by the bulge in the south skylight.

Two small holes were observed in the glass of the north skylight.

GENERAL ARRANGEMENTS.

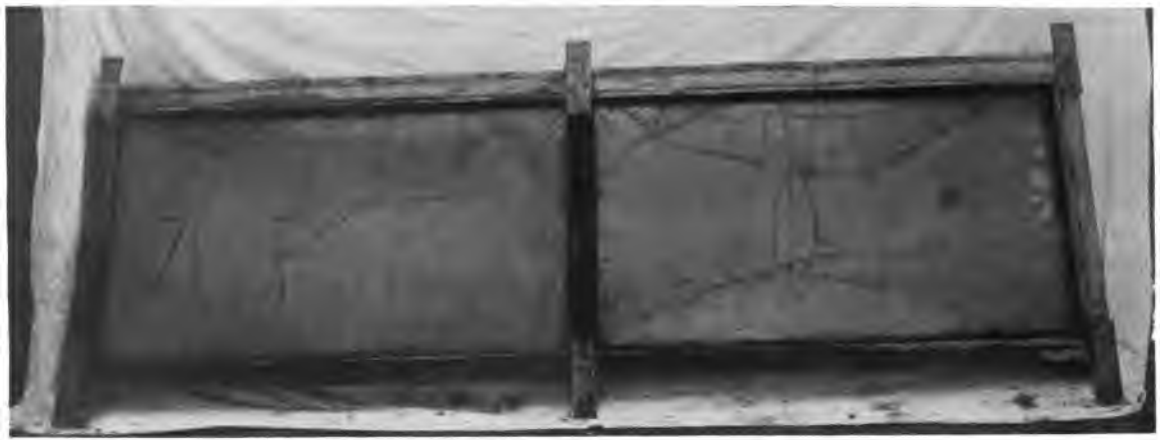
The Test was carried out in accordance with the procedure laid down by the Executive for investigations of this description, and conducted by a Sub-Committee of the Executive, comprising :—

Mr. Ellis Marsland, District Surveyor, Camberwell (Directing Member).

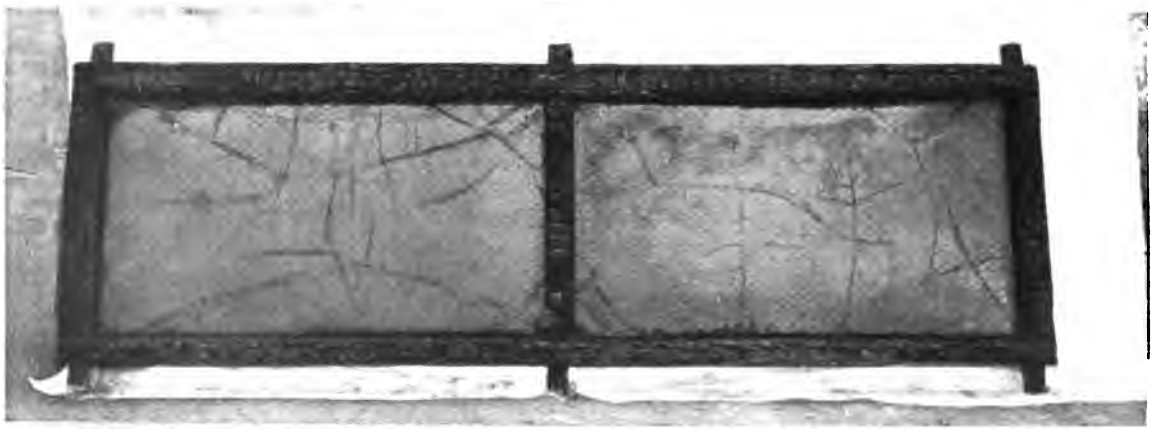
Mr. Max Clarke, A.R.I.B.A.

Mr. Robert Mond, M.A., F.R.S.E.

Mr. Thomas Kissack (Resident Engineer at the Testing Station) assisted the Sub-Committee.



THE SKYLIGHTS. *Fig.* 9. VIEW AFTER REMOVAL (FROM ABOVE).



THE SKYLIGHTS. *Fig.* 10. VIEW AFTER REMOVAL (FROM BELOW).

Mr. T. E. Leslie Alldridge (Royal Mint) superintended the instrument room.

The Council was represented by :—

Mr. Thomas Blashill, F.R.I.B.A., F.S.I., late Architect to the London County Council.

Sir John Taylor, K.C.B., H.M. Office of Works.

The Executive was represented by :—

Mr. Edwin O. Sachs (Chairman).

Mr. F. Hammond, F.R.I.B.A., District Surveyor, East Hampstead.

Mr. Edmund Woodthorpe, M.A., F.R.I.B.A., District Surveyor, Northern Division, City.

The Members' Testing Sub-Committee was represented by :—

Mr. George E. Monckton, M.A.

The general body of members was represented by :—

Mr. S. Flint Clarkson, F.R.I.B.A., District Surveyor, Chelsea.

Mr. R. P. Notley, F.R.I.B.A., F.S.I., District Surveyor, Bethnal Green.

Mr. W. White, F.R.I.B.A., F.S.A.

Messrs. Pilkington were represented by :—

Messrs. W. Lee Pilkington and D. W. Ames.

The following visitors attended by special invitation of the Executive :—

Admiral Sir H. H. Nicholson, K.C.B.

Mr. O. B. Leitch (Assistant Director of Works, Admiralty).

Mr. F. S. Capon (Factories and Workshops Branch, London County Council).

Major E. Palliser.

Captain G. McArthur, R.N.

Mr. J. F. Golding.

Mr. P. S. Greig.

Mr. H. Egan Hill (Messrs. Williamson, Hill & Co., Solicitors to the Committee).
Mr. E. Meyerstein.
Mr. J. D. O'Brien.
Mr. George Pritchard.

Signed,

For the Sub-Committee conducting the Test:
ELLIS MARSLAND (*Directing Member*).

For the Commercial Section:
FREDERIC R. FARROW.

For the Executive:
EDWIN O. SACHS (*Chairman*).

Published by the Committee as directed by the Executive.

GEORGE E. MONCKTON
(Secretary).

Date—September 25th, 1899.

Verified a true copy of the Report, ordered to be published.

WILLIAMSON, HILL & Co
(Solicitors).

Date—October 2nd, 1899.

Publications of the

BRITISH FIRE PREVENTION COMMITTEE.—No. 33.

Edited by Edwin O. Sachs.

FIRE TESTS WITH GLASS.

A CASEMENT GLAZED WITH $\frac{1}{4}$ *in.* PLATE GLASS.

A CASEMENT GLAZED WITH 32 *oz.* SHEET GLASS.

A CASEMENT GLAZED WITH "LEAD LIGHTS."

Particulars

OF

EXPERIMENTAL FIRE TESTS.

ALL RIGHTS RESERVED.

LONDON, 1899.

PUBLISHED AT THE OFFICES OF

THE BRITISH FIRE PREVENTION COMMITTEE

(Founded, 1897—Incorporated, 1899).

1, WATERLOO PLACE, PALL MALL.

One Shilling.

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No. 3.—THE PARIS BAZAAR FIRE.
No. 4.—THEATRE EXITS.
No. 5.—THE NEW YORK FIRE DEPARTMENT.
No. 6.—COTTON FIRES AND COTTON BALES.
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No. 8.—FIRE SERVICE IN FACTORIES, WORKS, &c.
No. 9.—LESSONS FROM FIRE AND PANIC.
No. 10.—HOW TO BUILD "FIRE-PROOF."
No. 11.—THE TESTS WITH UNPROTECTED COLUMNS.
No. 12.—THE EFFECT OF FIRE.
No. 13.—THE TESTING STATION OF THE B.F.P.C.
No. 14.—OFFICIAL FIRE TESTS WITH FLOORS (No. 1).
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No. 17.—THE TALL BUILDING UNDER TEST OF FIRE.
No. 18.—EXPERIMENTAL FIRE TESTS WITH FLOORS (B).
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No. 20.—OFFICIAL FIRE TESTS WITH GLAZING (No. 3).
No. 21.—EXPERIMENTAL FIRE TESTS WITH FLOORS (C).
No. 22.—EXPERIMENTAL FIRE TESTS WITH PARTITIONS (D & E).
No. 23.—OFFICIAL FIRE TESTS WITH FLOORS (No. 4).
No. 24.—EXPERIMENTAL FIRE TESTS WITH DOORS (G, H, AND I).
No. 25.—EXPERIMENTAL FIRE TESTS WITH DOORS (K AND L).
No. 26.—EXPERIMENTAL FIRE TESTS WITH DOORS (M AND N).
No. 27.—OFFICIAL FIRE TESTS WITH PARTITIONS (No. 7).
No. 28.—OFFICIAL FIRE TESTS WITH CEILINGS (No. 8).
No. 29.—OFFICIAL FIRE TESTS WITH GLASS (No. 5).
No. 30.—OFFICIAL FIRE TESTS WITH GLASS (No. 6).
No. 31.—OFFICIAL FIRE TESTS WITH GLASS (No. 11).
No. 32.—OFFICIAL FIRE TESTS WITH GLASS (No. 12).
No. 33.—EXPERIMENTAL PLAIN GLASS TESTS (O, P AND Q).
No. 34.—EXPERIMENTAL FIRE TESTS WITH FLOORS (R).
No. 35.—EXPERIMENTAL FIRE TESTS WITH DOORS (S AND T).
No. 36.—OFFICIAL FIRE TESTS WITH TREATED WOOD (No. 9).

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NOTE.

Surprise may be expressed at so much attention being given to testing the fire-resistance of ordinary forms of glazing.

Though the Executive would perhaps not accord the results of this investigation a prominent position when standing alone; they, however, hold that some data as to the resistance of ordinary forms of glazing are essential, if the results from the various tests with the special forms of "fire-resisting" glazing are to be properly appreciated, and it is to meet this requirement that the present Report has been issued.

EDWIN O. SACHS.

LONDON,
December 4th, 1899.

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For the Executive,

EDWIN O. SACHS, *Chairman.*

EXPERIMENTAL FIRE TESTS,

CONDUCTED BY THE EXECUTIVE

OF THE

British Fire Prevention Committee.

[FOUNDED 1897.—INCORPORATED 1899.]

FIRE TESTS, O,P.Q.—JULY 5TH, 1899

(O.) A CASEMENT GLAZED WITH ¼ IN. PLATE GLASS.
(P.) A CASEMENT GLAZED WITH 32 OZ. SHEET GLASS.
(Q.) A CASEMENT GLAZED WITH "LEAD LIGHTS."

OBJECT OF TEST.

To record the effect of a 30 minutes' fire increasing gradually to not more than 1,200° Fahr., together with the application of water, first at half time from outside and at the end of 30 minutes from inside, for two minutes each time.

SUMMARY OF EFFECT.

Within six minutes flame burst through the 32 oz. sheet glass casements, and half of the sheet had fallen. The other half fell within 12½ minutes.

Within seven minutes the lead glazing had collapsed.

Within 12 minutes flame burst through the ¼ in. plate casements, and within 14 minutes the whole sheet had fallen.

Note.—All three casements having fallen before the first 15 minutes had elapsed, no water was applied.

DESCRIPTION OF TESTING PLANT.

(*See Figs.* 1 *to* 4.)

The Testing Chamber used was located at the Committee's Testing Chamber, and was known as No. 2 Hut.

The Chamber was constructed, as shown, of stock

bricks with lime mortar, and measured 10 ft. by 10 ft. internally.

The ceiling of the chamber was constructed of solid 9 in. by 12 in. fir beams laid close together and grouted with fire clay. The ceiling was 7 ft. 6 in. above the pavement of the Chamber.

The Hut was covered in with a tarpaulin.

The door opening on the south side measured 2 ft. by 6 ft. 6 in., and was kept open during the test.

The fuel used was gas produced at the station, and the supply was regulated by valves and dampers.

The chamber was divided into two minor chambers by the casements under investigation, and there was an intervening central passage 2 ft. 4 in. wide. The West Chamber was used for this test, and measured 10 ft. by 3 ft. 10 in.

The gas was admitted through a mixing chamber of fire brick 10 ft. by 3 ft., as shown.

Two Roberts-Austen pyrometers were used for recording temperatures, the instruments being used for the observation records at points Nos. 1, 2, 3, 4 and 5. Points Nos. 1, 5, and 2 were situated in the Chamber; points Nos. 3 and 4 in the passage.

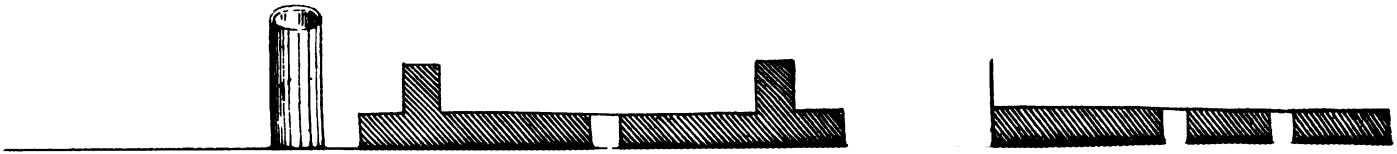
There were two small observation holes in the north wall. There were draught holes in the east, west and south walls.

CONSTRUCTION OF THE CASEMENTS.

(*See Figs.* 1 *to* 4).

On July 3rd, 1899, the casements were put into position, as shown. The fixing of the casements was carried out as follows :—

Upon the dwarf wall three teak rebated casements were fixed, reaching from the top of the dwarf wall to the soffit of the hut. The joints where the casements butted against one another were covered with 2 in. by $\frac{1}{2}$ in. teak fillets; teak fillets were also fixed where the casements butted against the walls and the soffit of the



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hut. The casements were glazed with three different kinds of glass, viz., that on the north end of hut with 32 oz. sheet glass, that in the middle with plate glass ¼ in. thick, and that on the south end with "lead glazing" (in 4 in. squares), and were secured to casements with teak beads.

Each casement showed glazing measuring 3 ft. by 4 ft.

THE TEST.

On Wednesday, July 5th, the test was undertaken The following is a log of the test:—

At 3 p.m. the meteorological observations taken at the Botanical Gardens, Regent's Park, read thus:—

State of weather, cloudy, fine, warm; Rain, none; Wind N.W.; Barometer 30·2; Attached Thermometer, 66° Fahr.; Dry Bulb, 71° Fahr.; Wet Bulb, 62·2 Fahr.

At 4.56 p.m. the gas was lighted.

At 4.57 p.m. the centre casement of plate-glass and the sheet of 32 oz. glass commenced cracking at the corners.

At 4.58 p.m. three squares cracked in the lead casement.

At 4.59 p.m. the lead casement commenced to bulge, and several squares cracked next the frame.

At 5 p.m. the centre casement cracked across.

At 5.1½ p.m. the flames burst through the sheet of 32 oz. glass, and half of it fell.

At 5.2 p.m. some of the lead cames melted, and four quarries fell out.

At 5.2½ p.m. the greater part of the lead glazed casement fell out, the cames melting.

At 5.8 p.m. flame burst through the centre casement of plate-glass.

At 5.8½ p.m. the remaining half of the 32 oz. sheet glass fell out.

At 5.10 p.m. the centre casement of plate-glass fell out bodily.

Note.—The whole of the glass having fallen out before the end of the first 15 mins., no water was applied, as specified in the "object of test," and no further observations were made.

The temperatures taken during the test read as follows:—

OBSERVATIONS TAKEN AT POINTS NOS. 1, 2, 3, 4 AND 5.
From 4.56 *p.m. to* 5.10 *p.m.*

	Inside.			Outside.	
Time.	No. 1. Fahr.	No. 5. Fahr.	No. 2. Fahr.	No. 3. Fahr.	No. 4. Fahr.
4.59 p.m.	450°	490°	500°	—	—
5.0 „	690°	600°	580°	—	—
5.2 „	1050°	1010°	1030°	200°	170°
5.3 „	900°	860°	900°	290°	250°
5.4 „	840°	760°	825°	325°	300°
5.5 „	1120°	820°	925°	510°	500°
5.6 „	1390°	1025°	1235°	610°	650°
5.7 „	1500°	1140°	1365°	825°	960°
5.8 „	1550°	1220°	1410°	1075°	1160°
5.9 „	—	—	—	—	1260°

GENERAL ARRANGEMENTS.

The test was carried out according to the procedure laid down by the Executive for investigations of this description, and conducted by a Sub-Committee of the Executive, comprising:—

Mr. Frederic R. Farrow, F.R.I.B.A. (Directing Member).

Mr. Max Clarke, A.R.I.B.A.

Mr. Ellis Marsland, District Surveyor, Camberwell.

Mr. Thomas Kissack, Resident Engineer at the Testing Station, assisted the Sub-Committee.

Mr. T. E. Leslie Aldridge (Royal Mint) superintended the instrument room.

The Executive was represented by :—

Mr. Edwin O. Sachs (Chairman).

Mr. M. F. Hammond, District Surveyor, Hampstead.

The Members' Testing Sub-Committee was represented by :—

Mr. George E. Monckton, M.A.

The general body of Members was represented by :—

Mr. W. H. Atkin Berry, A.R.I.B.A.

Mr. George Elkington, F.R.I.B.A., District Surveyor, Penge.

Mr. Chester Foulsham, District Surveyor, of Bromley-by-Bow.

Mr. Thomas Leach (Chief Officer, Wimbledon Fire Brigade).

Mr. G. McDonnell, A.R.I.B.A., District Surveyor, Islington, St. Luke's, &c.

The following visitors attended by special invitation of the Executive :—

Mr. Stransom (Theatres and Music Halls Branch, London County Council).

Mr. Edgar Worthington (Secretary, Inst.M.E.)

Signed,

For the Sub-Committee conducting the test:

FREDERIC R. FARROW

(*Directing Member*).

For the Executive:

EDWIN O. SACHS

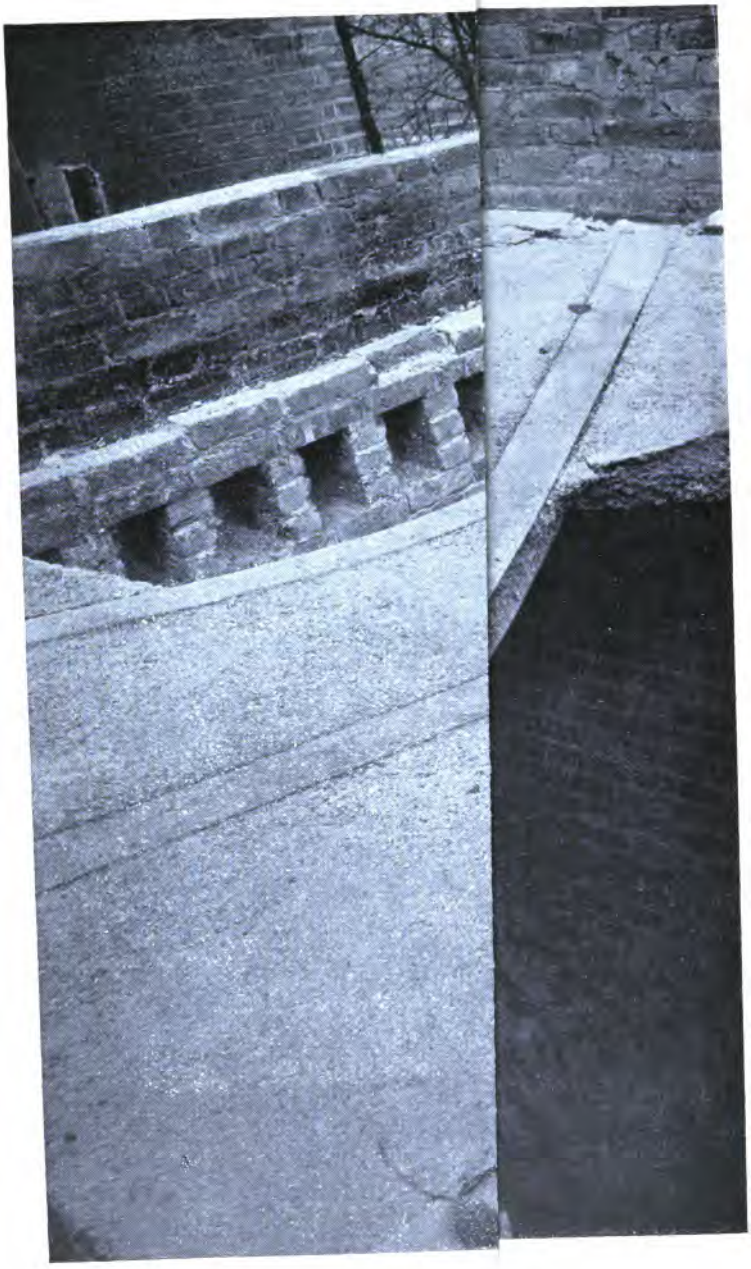
(*Chairman*).

Published by the Committee as directed by the Executive.

GEORGE E. MONCKTON,

(*Secretary*).

Date—29*th Nov.*, 1899.



Publications of the

BRITISH FIRE PREVENTION COMMITTEE.—No. 34.

Edited by Edwin O. Sachs.

FIRE TESTS WITH FLOORS.

A FLOOR

OF

STEEL JOISTS WITH COKE BREEZE CONCRETE.

Particulars

OF

EXPERIMENTAL FIRE TEST.

ALL RIGHTS RESERVED.

LONDON, 1899.

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OBJECTS OF THE COMMITTEE:

The main objects of the Committee are :—

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimising the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

To publish from time to time papers specially prepared for the Committee, together with records, extracts, and translations.

To undertake such independent investigations and tests of materials, methods and appliances as may be considered advisable.

The Committee's Reports on Tests with Materials, Methods of Construction, or Appliances are intended solely to state bare facts and occurrences, with tables, diagrams, or illustrations, and they are on no account to be read as expressions of opinion, criticisms, or comparisons.

NOTE.

Anyone conversant with the Metropolitan Building Act will at once realize the importance of the report here presented.

The Act may be taken to describe as "fire-resisting" a floor such as the one here under investigation, and this floor has collapsed after a fire test of under one hour and a half duration, in which, I would add, the maximum temperature reached at any one time was about 1700° Fahr.

The composition of the concrete used was exactly as defined by the London County Council as recently as March last, and the most favourable form of joist—the steel joist—was applied.

The Report should be read together with some of the earlier ones, where a similar floor tested was provided with a suspended ceiling, and another had wood joists, but was tested without any load being applied.

The lesson is of course obvious, and it only remains for the Committee to now publish the results obtained from floors in which a less favourable form of joist is used in order to fully explain why so many of the buildings classed as "fire-proof" are entirely gutted, to the dismay of those who have simply complied with the "official" requirements regarding fire protection, instead of applying a little common sense or taking expert advice.

EDWIN O. SACHS.

LONDON,

November 27th, 1899.

THE GENERAL ARRANGEMENTS FOR TESTS.

(*MEMORANDUM.*)

The purpose of the tests undertaken by the British Fire Prevention Committee is to obtain reliable data as to the exact fire-resistance of the various materials, systems of construction, or appliances used in building practice.

The tests are of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability is assured, records being mostly taken automatically or by photography, and the temperatures being easily regulated by the application of gas.

All reports on tests solely state the bare facts and occurrences, with tables, diagrams and illustrations, and on no account are reports to include expressions of opinion, nor should any expression be read as a comparison or criticism.

The general arrangement and direction of the tests are in the hands of the Executive, who act in accordance with certain principles laid down after careful study and experiment. The official tests are attended by the members of the Council and the members of the Committee in rotation.

As to the Testing Station, it comprises two houses standing in their own grounds near Regent's Park, and backing on to the Regent's Canal. The principal building is used for Committee Rooms and laboratory purposes, whilst the gardens are utilised for so-called "full-size" tests.

As to the financial aspect of the station, the establishment expenses are being met by a special subscription. As far as the funds of the Committee permit, investigations and experimental tests with ordinary (*i.e.*, not patented) forms of construction are undertaken from time to time and duly reported on. Official tests with patented materials, makers' systems, etc., etc., are subject to a scale of charges, but these charges are so figured as to only just cover the actual cost. Any surplus is refunded. The Testing Station is also open to members for such private research work or tests they may desire to undertake.

The services of the members participating in the management of the station, conducting or attending tests, are given entirely gratuitously.

For the Executive,

EDWIN O. SACHS, *Chairman.*

EXPERIMENTAL FIRE TESTS

CONDUCTED BY THE EXECUTIVE

OF THE

British Fire Prevention Committee.

[FOUNDED 1897—INCORPORATED 1899.]

FIRE TEST R.—OCTOBER 18TH, 1899.

A Floor of Steel Joists and Coke Breeze Concrete.

OBJECT OF TEST.

To record the effect of a fire of two and a half hours' duration, commencing with a temperature of 500° Fahr., gradually increasing to a temperature not exceeding 2,300° Fahr., followed at the end of the two and a half hours by the application of a stream of water for three minutes and the consequent rapid cooling.

Note.—The area of the floor under investigation to be 100 feet superficial in the clear (10 ft. by 10 ft.).

The floor was to be loaded with 168 lbs. per foot distributed.

The time allowed for construction and drying was six weeks (Autumn).

SUMMARY OF EFFECT.

After twenty minutes, and at a temperature of about 1,200° Fahr., the steel joists began to deflect, and continued to deflect until a maximum deflection of 10½ ins. was recorded.

After about one hour and twenty-five minutes, and at a temperature of about 1,650° Fahr., the bulk of the concrete in the two outer bays collapsed bodily.

The concrete in the two remaining bays and the concrete that fell was slightly disintegrated on the underside.

The concrete that fell was not broken.

Note.—The two outer bays having collapsed, the test was concluded. The highest temperature obtained was materially lower than the 2,300° Fahr. mentioned in "The Object of Test."

DESCRIPTION OF TESTING PLANT.

(*See Figs.* 1 *to* 4.)

The testing chamber was located at the Committee's Testing Station, and was known as "No. 4 Hut."

The chamber was constructed, as shown, of stock bricks with lime mortar, and measured 10 ft. by 10 ft. internally.

The ceiling of the floor tested was 8 ft. above the pavement of the chamber.

The hut was covered in every night with tarpaulins.

The door-opening on the north side measured 2 ft. by 6 ft. 6 in., and was bricked up on the morning of the test.

The fuel used was gas produced at the station, and the supply was regulated by valves and dampers.

The gas was admitted through two mixing chambers of fire brick, each 10 ft. by 3 ft., as shown.

Two Roberts-Austen pyrometers were used for recording temperatures, the first to take a continuous record from point No. 5, and the second to take four observation records from points 1, 2, 3, 4.

The load was of bricks, distributed evenly on the surface of the floor.

There were two observation holes in the south wall, one in the east wall, one in the west wall and one in the north wall in door opening.

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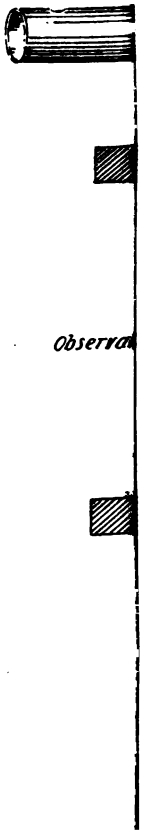


Observa

The draught holes were in the east and west walls.

The photographs were partly taken by daylight and partly by flash-light.

The stream of water was applied through a branch with ½-in. nozzle, equipped with a pressure gauge, and supplied from a manual fire engine similarly equipped.

CONSTRUCTION OF THE FLOOR.

(*See Figs.* 1 *to* 4.)

The construction of the floor, illustrated in Figs. 1 to 4 was as follows:—

On September 7th, 1899, wood centering was put up to support the concrete.

On September 8th, three steel joists, 5. in by 4½ in., weighing 19 lbs. per foot, were fixed on the 4½ in. offset of the walls, and 2 ft. 6 in. centre to centre.

Concrete was filled in on the top of the centering and between the steel joists to the full depth of the joists, viz., 5 inches.

The concrete was composed of coke breeze and Portland cement in the proportion of five parts of coke breeze and one part of Portland cement.

The coke breeze was obtained from the gas works at Kensal Green and was dry before being used.

The cement was obtained in the open market.

The concrete was turned over four times dry and four times wet and was mixed in batches of 1½ yards at a time. The quantity of water used for each batch was 30 gallons.

The concrete was carried to the floor in buckets and filled in the centering in two layers of 2½ inches each, which were trodden in and beaten with the flat side of a shovel.

The undersides of the steel joists were left exposed.

On September 25th, the centering was removed, having been up 18 days.

On September 8th, during the operation of concreting, the weather report was as follows:—Fine; Wind, N.N.W.; Highest in the air, 76° Fahr.

During September, the rainfall for the month (taken at Camden Square, was 2·65 in. with a maximum of ·95 on September 29th. The maximum temperature was 88·1° Fahr., and the minimum 36·4° Fahr.

Preparations for Test.

On October 13th, coke fires were lighted in the hut and kept alight for two days of 16 hours each.

On October 16th, the floor was loaded with bricks weighing 13,600 lbs., equal to a distributed load of 168 lbs. (1½ cwt.) per square foot, over an area of 9 ft. by 9 ft.

On October 17th, the gas was lighted for four hours and kept low.

On October 18th, the gas was lighted at 7 a.m. and kept low untill the test began at 3.15 p.m.

THE TEST.

On October 18th the test was undertaken. The following is a log of the test:—

At 1.15 p.m. the floor was intact.

At 3 p.m. the Meteorological observations taken at the Botanic Gardens, Regent's Park, read as follows:—

State of weather, fine, bright; Rain, none; Wind, E.S.E.; Barometer, 30·34; Attached Thermometer, 53° Fahr.; Dry Bulb, 50° Fahr.; Wet Bulb, 48·5° Fahr.

The table given below shows the temperatures taken from the four pyrometer observation points in the hut, as shown on the drawings as Nos. 1, 2, 3, 4.

Note.—No record was obtained from point No. 5, the continuous recorder.

OBSERVATIONS TAKEN AT POINTS NOS. 1, 2, 3, 4.

From 1.17 *p.m. to* 2.50 *p.m.*

TIME	No. 1	No. 2	No. 3	No. 4
1.17 p.m.	450° Fah.	525° Fah.	510° Fah.	500° Fah.
1.22 „	800° „	1000° „	840° „	760° „
1.25 „	875° „	1050° „	925° „	800° „
1.30 „	975° „	1200° „	1110° „	950° „
1.35 „	1110° „	1320° „	1250° „	1130° „
1.40 „	1190° „	1375° „	1290° „	1185° „
1.45 „	1200° „	1375° „	1300° „	1220° „
1.50 „	1340° „	1500° „	1410° „	1315° „
1.55 „	1375° „	1475° „	1420° „	1320° „
2.0 „	1450° „	1540° „	1490° „	1425° „
2.5 „	1510° „	1595° „	1530° „	1450° „
2.10 „	1550° „	1640° „	1600° „	1490° „
2.15 „	1600° „	1680° „	1620° „	1520° „
2.20 „	1610° „	1690° „	1650° „	1545° „
2.25 „	1660° „	1720° „	1690° „	1590° „
2.30 „	1700° „	1740° „	1720° „	1620° „
2.35 „	1650° „	1675° „	1690° „	1600° „
2.40 „	1700° „	1720° „	1650° „	1600° „
2.45 „	1250° „	1250° „	1300° „	1250° „
2.50 „	1130° „	1050° „	1200° „	1150° „

At 1.15 p.m. the gas was turned on.

At 1.32 p.m. cracks were observed in the concrete at A, B, C, and D. (*See* Fig. 5.)

At 1.35 p.m. the steel joists began to deflect (*see* table below) and the deflection increased until the concrete in the two outer bays fell in. (*See* Fig. 5.)

At 2.10 p.m. a crack in the concrete was observed at E.

At 2.25 p.m. the concrete in the outer bay at A, against the lower edge of steel joist L, had dropped about $1\frac{1}{2}$ inches below joist. Also at B it had dropped about 1 inch. Also at C and D it had dropped about $\frac{3}{4}$ inch. (*See* Fig. 5.)

At 2.41 p.m. the bulk of the concrete in the eastern bay fell. (*See* Fig. 5.)

At 2.42 p.m. the bulk of the concrete in the western bay fell. (*See* Fig. 5.)

Note.—The two outer bays having collapsed, the test was concluded. The highest temperature obtained was materially lower than the 2,300° Fahr. mentioned in "The Object of Test."

At 2.52 p.m. the gas was turned off and water was applied to the soffit of the floor, at 20 lbs. pressure, for two minutes.

At 2.54 p.m. the test was closed. The joists were much deflected, and the concrete that had not fallen was cracked transversely. (*See* Fig 5.)

The deflections observed are explained on the following diagram and table:—

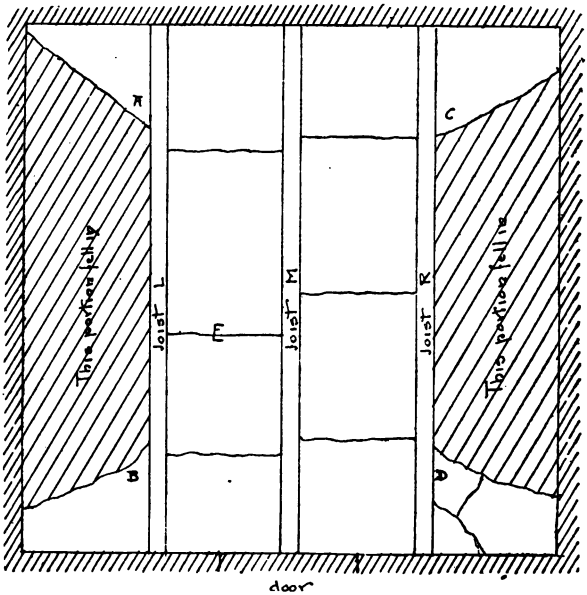


Fig. 5. PLAN OF FLOOR AFTER TEST.

Time.	Joist L.	Joist M.	Joist R.	Average Temp.
1.35 p.m.	$1\frac{1}{8}$ inches	1 inch	1 inch	1130°
1.38 ,,	$1\frac{1}{4}$,,	$1\frac{1}{8}$,,	$1\frac{1}{8}$,,	1150°
1.40 ,,	$1\frac{5}{8}$,,	$1\frac{1}{4}$,,	$1\frac{1}{4}$,,	1185°
1.45 ,,	$1\frac{1}{2}$,,	$1\frac{5}{8}$,,	$1\frac{5}{8}$,,	1220°
1.50 ,,	$1\frac{1}{2}$,,	$1\frac{5}{8}$,,	$1\frac{5}{8}$,,	1315°
1.55 ,,	$1\frac{3}{4}$,,	$1\frac{3}{4}$,,	$1\frac{3}{4}$,,	1320°
2.0 ,,	$1\frac{7}{8}$,,	$1\frac{7}{8}$,,	$1\frac{3}{4}$,,	1425°
2.5 ,,	$2\frac{1}{8}$,,	2 ,,	2 ,,	1450°
2.15 ,,	$2\frac{1}{4}$,,	$2\frac{3}{8}$,,	$2\frac{1}{4}$,,	1520°
2.20 ,,	$2\frac{3}{4}$,,	$2\frac{3}{4}$,,	$2\frac{5}{8}$,,	1545°
2.25 ,,	$3\frac{1}{8}$,,	$3\frac{1}{8}$,,	3 ,,	1590°
2.30 ,,	$3\frac{3}{4}$,,	$3\frac{3}{4}$,,	$3\frac{3}{4}$,,	1620°
2.35 ,,	5 ,,	5 ,,	5 ,,	1650°
2.40 ,,	$7\frac{1}{8}$,,	$6\frac{3}{4}$,,	$6\frac{1}{4}$,,	1650°
2.45 ,,	$10\frac{1}{2}$,,	$6\frac{1}{4}$,,	7 ,,	1250°
2.50 ,,	—	—	—	1200°

OBSERVATIONS AFTER TEST.

(See Figs. 6 to 8).

On October 19th the photographs shown in Figs. 6, 7, and 8 were taken.

On October 19th the load was removed.

On the same day the floor was examined, and it was found that joist L had a permanent set of 12 inches. Joist M had a permanent set of $11\frac{3}{4}$ inches. Joist R had a permanent set of $12\frac{1}{2}$ inches.

The concrete that had not fallen had developed some further cracks, (*see* Fig. 5).

The concrete that had fallen was not broken in pieces.

The concrete was but little deteriorated, except for about an inch in depth on the side exposed to the fire.

GENERAL ARRANGEMENTS.

The Test was carried out in accordance with the procedure laid down by the Executive for investigations of this description, and carried out by a sub-committee comprising:—

Mr. Ellis Marsland, District Surveyor, Camberwell (Directing Member).
Mr. Chas. E. Goad, M.Am.Soc.C E., M.Can.Soc.C.E.
Mr. Frederic Hammond, F.R.I.B.A., District Surveyor, East Hampstead.

Mr. Thomas Kissack, Resident Engineer at the Testing Station, assisted the Sub-Committee.

Mr. T. E. Leslie Alldridge (Royal Mint), and Mr. H. B. White, M.I.E.E., superintended the instrument room.

The attendance at the Test was limited according to procedure as follows:—

The Council was represented on the afternoon of the Test by:—

Mr. H. H. Collins, F.R.I.B.A., F.S.I., District Surveyor, Eastern Division, City of London.

The Executive was represented by:—

Mr. Edwin O. Sachs (Chairman).

The Commercial Section was represented by:—

Mr. Frederic R. Farrow, F.R.I.B.A. (Chairman).

The Members' Testing Sub-Committee was represented by:—

Mr. George F. Monckton, M.A.
Mr. Emil Schweich.

THE FLOOR. *Fig.* 6. GENERAL VIEW AFTER TEST (FROM BELOW.)

A number of visitors, representing Daily, Technical, and Insurance Press, attended this test by special invitation of the Executive.

Signed,

For the Sub-Committee conducting Test:

ELLIS MARSLAND (*Directing Member*).

For the Commercial Section:

FREDERIC R. FARROW.

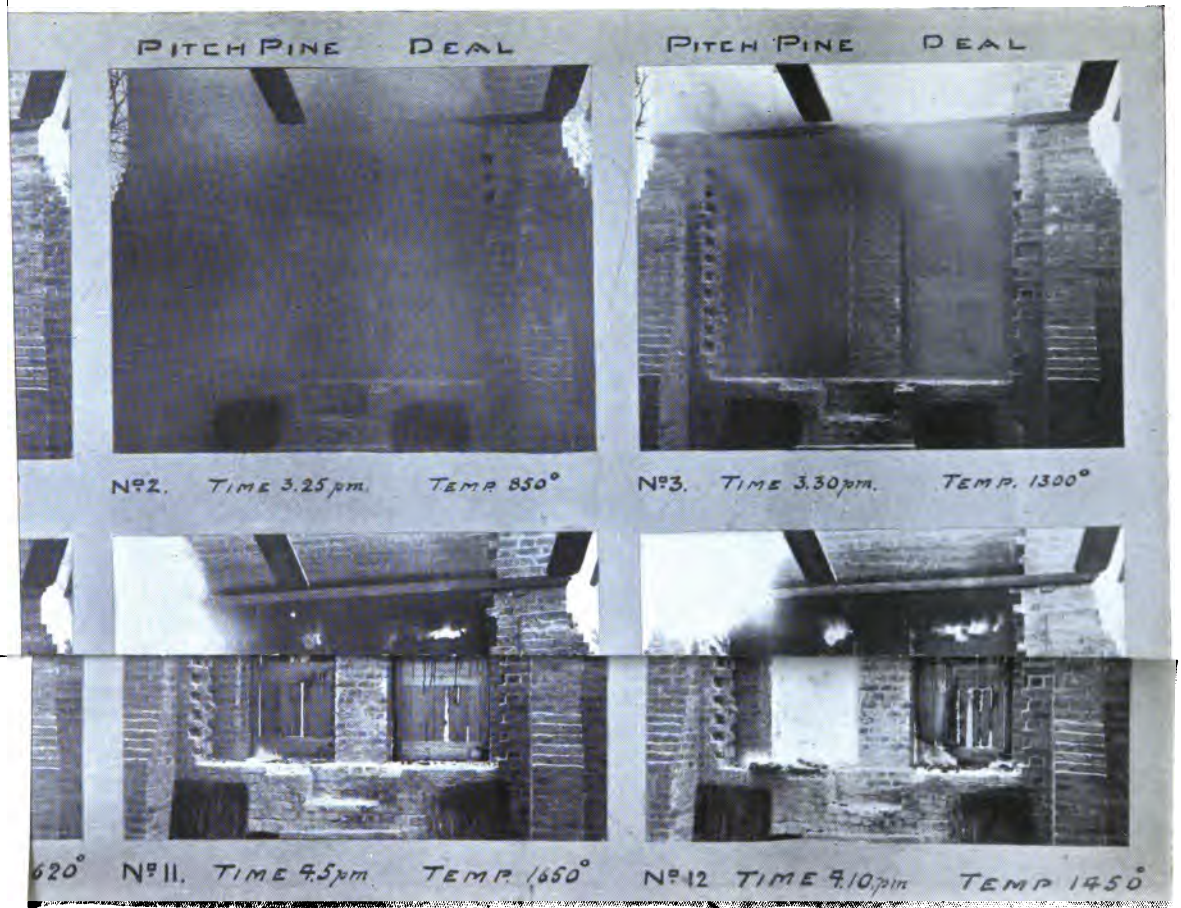
For the Executive:

EDWIN O. SACHS (*Chairman*).

Published by the Committee as directed by the Executive.

GEORGE E. MONCKTON,
(Secretary).

Date—23rd November, 1899.



IRE DOORS. *Figs.* 1 *to* 12. VIEWS DURING TEST (TAKEN FROM OUTSIDE).

Publications of the

BRITISH FIRE PREVENTION COMMITTEE.—No. 35.

Edited by Edwin O. Sachs.

FIRE TESTS WITH DOORS.

A 2-in. FRAMED PITCH PINE DOOR, WITH 2-in. SOLID PANELS.

A 2-in. FRAMED DEAL DOOR, WITH 2 in. SOLID PANELS.

Particulars

OF

EXPERIMENTAL FIRE TESTS.

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LONDON, 1899.

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Two Shillings and Sixpence nett.

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No. 2.—AMERICAN OPINIONS ON FIRE PROTECTION.
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No. 12.—THE EFFECT OF FIRE.
No. 13.—THE TESTING STATION OF THE B.F.P.C.
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No. 15.—CONFLAGRATIONS DURING THE LAST TEN YEARS.
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No. 17.—THE TALL BUILDING UNDER TEST OF FIRE.
No. 18.—EXPERIMENTAL FIRE TESTS WITH FLOORS (B).
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No. 20.—OFFICIAL FIRE TESTS WITH GLAZING (No. 3).
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No. 22.—EXPERIMENTAL FIRE TESTS WITH PARTITIONS (D & E)
No. 23.—OFFICIAL FIRE TESTS WITH FLOORS (No. 4).
No. 24.—EXPERIMENTAL FIRE TESTS WITH DOORS (G, H, AND I).
No. 25.—EXPERIMENTAL FIRE TESTS WITH DOORS (K AND L).
No. 26.—EXPERIMENTAL FIRE TESTS WITH DOORS (M AND N).
No 27.—OFFICIAL FIRE TESTS WITH PARTITIONS (No. 7).
No. 28.—OFFICIAL FIRE TESTS WITH CEILINGS (No. 8).
No. 29.—OFFICIAL FIRE TESTS WITH GLASS (No. 5).
No. 30.—OFFICIAL FIRE TESTS WITH GLASS (No. 6).
No. 31.—OFFICIAL FIRE TESTS WITH GLASS (No. 11).
No. 32.—OFFICIAL FIRE TESTS WITH GLASS (No. 12).
No. 33.—EXPERIMENTAL PLAIN GLASS TESTS (O, P AND Q).
No. 34.—EXPERIMENTAL FIRE TESTS WITH FLOORS (R).
No. 35.—EXPERIMENTAL FIRE TESTS WITH DOORS (S AND T).
No. 36.—OFFICIAL FIRE TESTS WITH TREATED WOOD (No. 9).

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OBJECTS OF THE COMMITTEE.

The main objects of the Committee are:—

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimising the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

To publish from time to time papers specially prepared for the Committee, together with records, extracts and translations.

To undertake such independent investigations and tests of materials, methods and appliances as may be considered advisable.

The Committee's Reports on Tests with Materials, Methods of Construction, or Appliances are intended solely to state bare facts and occurrences, with tables, diagrams, or illustrations, and they are on no account intended to read as expressions of opinion, criticisms, or comparisons.

THE DOORS. *Fig.* 6. VIEW SHOWING DOORS BEFORE TEST (FROM OUTSIDE).

NOTE.

The report here under consideration again deals with doors, and should be read in connection with other reports on this series of investigations, the reports in question issued to date being those embodied in Publications Nos. 24, 25, and 26, whilst a number of others are already in the press, or in course of preparation.

The doors which have been here reported on were constructed of pitch pine and of deal respectively, and as far as size and the form of construction is concerned, they scarcely differ from the oak door and the teak door reported upon in publication No. 26.

Four more doors of practically identical construction and dimensions are being dealt with, *i.e.*, one of mahogany, one of poplar, one of walnut, and one of Austrian oak. The Executive is further considering the effect of fire on forms of wood door construction different to that here shown, and will then proceed to undertake further tests, firstly with armoured wood doors, and secondly with iron doors of various pattern and make.

The report on the doors here under consideration speaks for itself, and the only points I think I should refer to are, firstly that the doors are again hung to open inwards into the fire, and secondly that the Committee is again indebted for the excellent photographs to the arrangements made by Mr. Ellis Marsland.

EDWIN O. SACHS.

LONDON,

December 9th, 1899.

THE GENERAL ARRANGEMENTS FOR TESTS.

(MEMORANDUM.)

The purpose of the tests undertaken by the British Fire Prevention Committee is to obtain reliable data as to the exact fire-resistance of the various materials, systems of construction, or appliances used in building practice.

The tests are of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability is assured, records being mostly taken automatically, or by photography, and the temperatures being easily regulated by the application of gas.

All reports on tests solely state the bare facts and occurrences, with tables, diagrams and illustrations, and on no account are reports to include expressions of opinion, nor should any expression be read as a comparison or criticism.

The general arrangement and direction of the tests are in the hands of the Executive, who act in accordance with certain principles laid down after careful study and experiment. The official tests are attended by the members of the Council and the members of the Committee in rotation.

As to the Testing Station, it comprises two houses standing in their own grounds near Regent's Park, and backing on to the Regent's Canal. The principal building is used for Committee Rooms and laboratory purposes, whilst the gardens are utilised for so-called "full-size" tests.

As to the financial aspect of the station, the establishment expenses are being met by a special subscription. As far as the funds of the Committee permit, investigations and experimental tests with ordinary (*i.e.*, not patented) forms of construction are undertaken from time to time and duly reported on. Official tests with patented materials, makers' systems, etc., etc., are subject to a scale of charges, but these charges are so figured as to only just cover the actual cost. Any surplus is refunded. The Testing Station is also open to members for such private research work or tests they may desire to undertake.

The services of the members participating in the management of the station, conducting or attending tests, are given entirely gratuitously.

For the Executive,

EDWIN O. SACHS, *Chairman.*

EXPERIMENTAL FIRE TESTS

CONDUCTED BY THE EXECUTIVE

OF THE

British Fire Prevention Committee.

[FOUNDED 1897.—INCORPORATED 1899.]

FIRE TESTS S AND T, OCTOBER 18TH, 1899.

S.—A 2-in. Framed Pitch Pine Door with 2-in. Solid Panels.

T.—A 2-in. Framed Deal Door with 2-in. Solid Panels.

OBJECT OF TEST.

To record the effect of a fierce fire of one hour, gradually increasing to a temperature of 2,000° Fahr.

Note.—The fire was to be applied from one side, and the doors were to open inwards on to the fire side.

Note.—The door-openings were to be approximately 3 ft. 3 in. by 6 ft. 9 in.

SUMMARY OF EFFECT.

PITCH PINE DOOR.

In 20 minutes flame appeared over top rail of door.

In 36 minutes flame had extended down top rail to upper panels of door, and panels had bulged.

In 50 minutes the upper panels and muntin fell out.

In 57 minutes the remainder of the door collapsed and fell outwards.

Deal Door.

In 17 minutes flame appeared over top rail of door.

In 30 minutes flame had extended down top rail to upper panels of door.

In 50 minutes flame extended down door to below centre of upper panels, and fire was seen through lower panel.

In 57 minutes the door fell in bodily.

DESCRIPTION OF TESTING PLANT.

(*See Figs.* A, B, C *and* D.)

The Testing Chamber used was located at the Committee's Testing Station, and was known as No. 2 Hut.

The hut was constructed, as shown, of stock bricks with lime mortar, and measured 10 ft. by 10 ft. internally. The ceiling of the hut was 9 ft. 6 in. above the pavement of the chamber, and was formed of solid wood beams grouted with fire-clay.

The fuel used was gas produced at the station, and the supply was regulated by valves and dampers.

The gas was admitted through two mixing chambers of fire-brick, as shown.

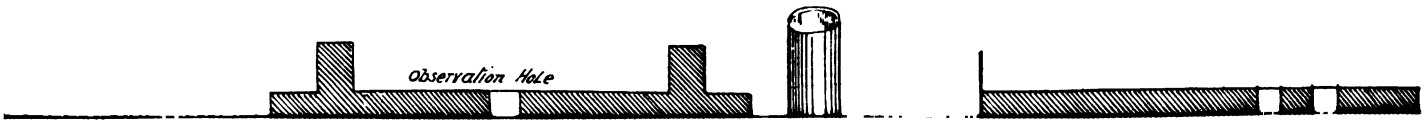
Two Roberts-Austen pyrometers were used for recording temperatures, to take four observation records from points Nos. 1, 2, 3, 4, and one automatic record from point No. 5. Points Nos. 2 and 3 were outside the doors, and the others on the fire side of doors. (*See roof plan*).

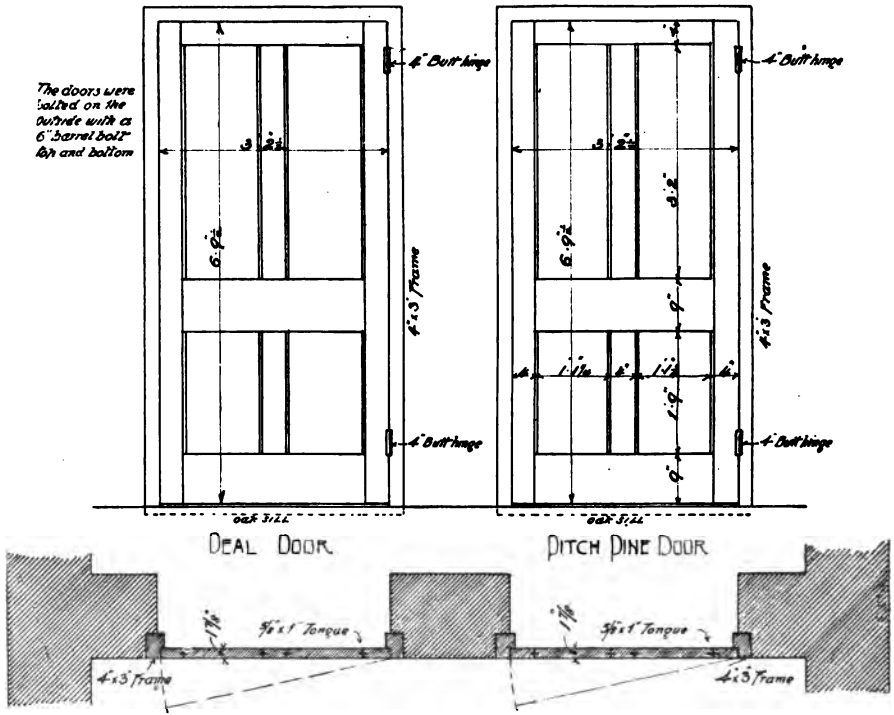
There were observation holes in the east and west walls, closed by movable iron shutters.

The draught holes were in the east and west walls.

The photographs were taken by daylight.

A brick wall 14 in. thick, with two openings 3 ft. 3 in. wide, 7 ft. high, was built across the hut, running from east to west. It was built 13 in. back from the main wall. The wall was carried up to the ceiling, the height between floor and ceiling being 9 ft. 6 in. The two openings were arched over with brick arches in two half-brick rings. The wall was built with gauged stuff.


Observation Hole



DETAILS OF DOORS. *Figs.* E, F. INSIDE.

CONSTRUCTION OF THE DOORS.

The Pitch Pine Door.

(See Figs. E *to* G*).*

The door and frame were constructed of pitch pine, from Mobile, Alabama, U.S.A.

The frame was 4 in. by 3 in., with $\frac{1}{2}$ in. rebate, and was secured to brick reveal with deal plugs. The frame had an oak sill.

The door was constructed of 2 in. planks, which measured $1\frac{7}{8}$ in. when finished.

The door was in 4 panels, bead butt both sides, and the panels were the full thickness of door.

The styles and top rail were 4 in. wide; the centre and bottom rail were 9 in. wide.

The panels were tongued to styles and rails with 1 by $\frac{5}{8}$ in. oak tongues.

The door was hung with 1 pair of 4-in. wrot iron butts, and fastened with two 6-in. iron barrel bolts, fixed on the outside of door.

The Deal Door.

The deal door was of yellow deal, from Archangel, and was similarly constructed and hung.

Note.—The doors and frames were fixed in the hut on October 17th. The deal door was on the west side, and the pitch pine door on the east side. All joints against brickwork were stopped with fire-clay.

The doors stood 12 in. above floor of hut.

PREPARATIONS FOR TEST.

On the afternoon of October 18th, at 2.30 p.m., photographs were taken of the two doors from the outside. (See Fig. G).

THE TEST.

(See Figs. 1 *to* 12, *and* H *to* L*).*

On October 18th the test was undertaken. The following is the log of the test:—

At 3 p.m. the meteorological observations taken at the Botanic Gardens, Regent's Park, read as follows:—"State of weather, fine and bright; Wind, E.S.E.; Barometer, 30·34; Attached Thermometer, 53° Fahr.; Dry bulb, 50° Fahr.; Wet bulb, 48·5° Fahr."

The following temperature observations were taken during the test from points Nos. 1, 2, 3, and 4.

OBSERVATIONS TAKEN AT POINTS, 1, 2, 3, 4.
From 3.15 *p.m. to* 4.12 *p.m.*

	Inside.		Outside.	
Time.	No. 1. Fahr.	No. 4. Fahr.	No. 2. Fahr.	No. 3. Fahr.
3.15 p.m.	—	—	—	—
3.20 „	290°	310°	—	—
3.25 „	650°	1,075°	—	—
3.27 „	1,275°	1,290°	—	—
3.30 „	1,290°	1,350°	50°	60°
3.33 „	1,475°	1,440°	75°	150°
3.36 „	1,495°	1,495°	100°	275°
3.39 „	1,520°	1,450°	190°	395°
3.42 „	1,490°	1,500°	245°	450°
3.45 „	1,550°	1,560°	400°	575°
3.48 „	1,560°	1,530°	830°	670°
3.51 „	1,500°	1,450°	1,075°	750°
3.54 „	1,490°	1,500°	1,200°	810°
3.57 „	1,600°	1,625°	1,280°	1,120°
4.0 „	1,620°	1,620°	1,120°	1,295°
4.3 „	1,650°	1,680°	500°	1,375°
4.6 „	1,525°	1,600°	—	1,440°
4.9 „	1,500°	1,550°	—	1,450°
4.12 „	1,400°	1,440°	380°	1,450°

Note.—No record was obtained from point No. 5.

PITCH PINE DOOR.	DEAL DOOR.
At 3.15 p.m. the gas was turned on.	At 3.15 p.m. the gas was turned on.
Observations on Inside.	*Observations on Inside.*
At 3.21 p.m. door caught fire.	At 3.21½ p.m. door caught fire.
At 3.25 p.m. door was flaming.	At 3.25 p.m. door was flaming.
	At 3.31 p.m. door was much charred all over surface.
	At 3.32 p.m. the flames were stronger.
At 3.42 p.m. and after, door flaming freely all over.	At 3.42 p.m. and after door flaming freely all over.
Observations on Outside.	*Observations on Outside.*
At 3.23 p.m. smoke issuing between rebate of frame and top rail of door.	At 3.21 p.m. smoke appeared between rebate of frame and styles of door on each side towards top.
At 3.24 p.m. dense smoke issuing between rebate of frame and meeting style and top rail of door. See Fig 2.	At 3.24 p.m. dense smoke issuing between rebate of frame and top rail of door. See Fig. 2.

PITCH PINE. DOOR—*continued.*

At 3.35 p.m. flame appeared between rebate of frame and top rail of door by bolt. See Fig. 5.

At 3.40 p.m. flame extending along top rail. See Fig 6.

At 3.41 p.m. the door was cool to the hand generally, but warm about 1 ft. above lock rail.

At 3.42 p.m. flame appeared through west top panel at upper edge.

At 3.46 p.m. resin in wood running down door in streaks. See Fig. 7.

At 3.48 p.m. lower edge of top panels bulging outwards and flame spreading down top panels. See Figs. 7 and 8.

At 3.50 p.m. the two top panels and west bottom panel were bulging outwards.

DEAL DOOR—*continued.*

At 3.32 p.m. flame burst between rebate of frame and top rail of door. See Fig. 4.

At 3.35 p.m. flame spreading down top rail and also down hanging style. See Fig. 5.

At 3.41 p.m. the door was cool to the hand generally, but warm about 1 ft. above lock rail.

At 3.42 p.m. flame appeared through joint between top rail and the two upper panels.

At 3.46 p.m. flame extending down top rail to top panels of door. See Fig. 7.

At 3.50 p.m. the bottom west panel was bulging outwards, flame appeared in two places at the rebate next the butts, also in centre of bottom rail.

PITCH PINE DOOR—*continued.*

At 3.51 p.m. fire extending down the top panels. See Fig. 8.

At 3.53 p.m. fire still extending down the top panels. See Fig. 9.

At 3.55 p.m. flame appeared on east side between rebate of door frame and door and along bottom edge of bottom rail near to hanging style and through top east panel at bottom corner.

At 3.57 p.m. flame appeared through joints between top muntin and panels and styles. See Fig. 10.

At 3.58 p.m. the lock rail was bulging outwards, the muntin between top panels well alight.

At 4 p.m. flame appeared through bottom west panel. The upper part of the door was well alight.

DEAL DOOR—*continued.*

At 3.51 p.m. flame appeared through rebate between frame and hanging style from 4 to 14 inches from the bottom.

At 3.53 flame appeared through the joint between bottom right-hand panel and centre style. This panel bulging increasingly outwards.

At 3.55 p.m. flame appeared through rebate next lower bolt to depth of bottom rail and through joint between the lock rail and hanging style.

At 3.58 p.m. the bottom right-hand panels were bulging out.

At 3.59 p.m. flame appeared through joint between the lower muntin and right bottom panel. See Fig. 10.

PITCH PINE DOOR—*continued.*

At 4.4 p.m. the top rail fell out.

At 4.5 p.m. flame appeared through joints between bottom panels and styles. The top panels and muntin fell out.

At 4.10 p.m. the bottom panels fell out. See Fig. 12.

At 4.12 p.m. the bottom muntin fell out. The door collapsed outwards.

At 4.13 p.m. the gas was shut off.

At 4.14 p.m. water was applied and the test was closed.

DEAL DOOR—*continued.*

At 4.5 p.m. flame appeared through bottom west panel. See Fig. 11.

At 4.10 p.m. the top rail fell out. Door flaming nearly all over. See Fig. 12.

At 4.11 p.m. The west bottom panel fell out.

At 4.12 p.m. the door fell in bodily.

At 4.13 p.m. the gas was shut off.

At 4.14 p.m. water was applied and the test was closed.

Fig. H. View Showing Condition of Doors after 25 Minutes.
Pitch Pine. Deal.

Fig. 1. View Showing Condition of Doors after 40 Minutes.
Pitch Pine. Deal.

Fig. K. View Showing Condition of Doors after 45 Minutes.
Pitch Pine. Deal.

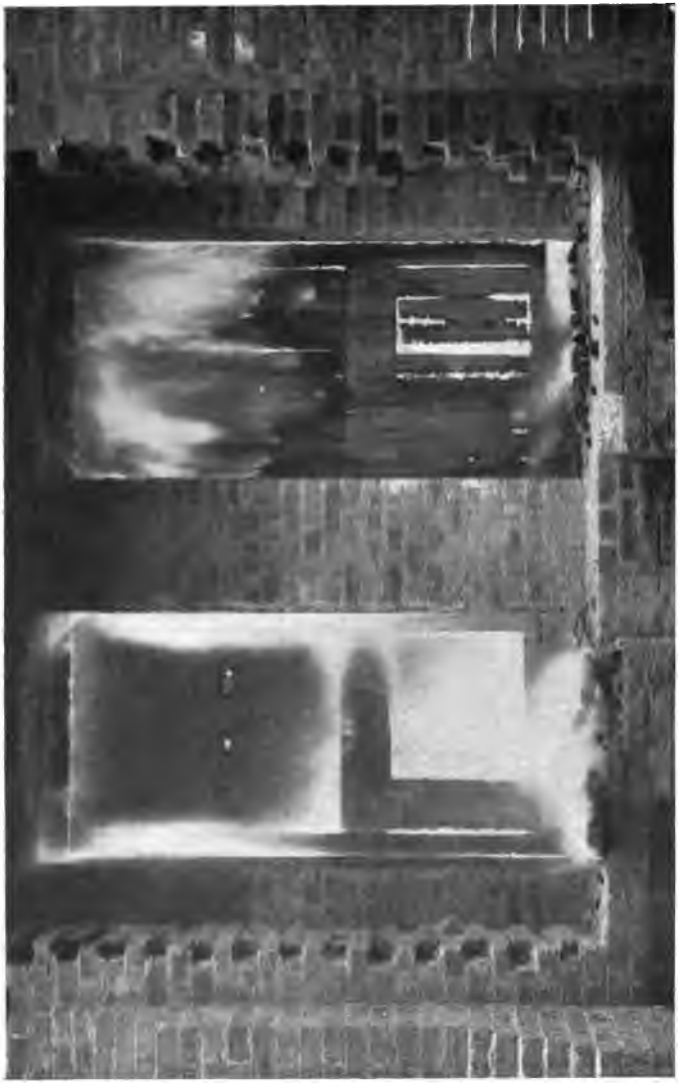


Fig. L. View Showing Condition of Doors after 55 Minutes.
Pitch Pine. Deal.

OBSERVATIONS AFTER TEST.

PITCH PINE DOOR.	DEAL DOOR.
On October 18th, later. The door frame was still in position, but charred on the inside face.	On October 18th, later. The door frame was still in position, but charred on the inside face.

GENERAL ARRANGEMENTS.

The test was carried out as an experimental test in accordance with the procedure laid down by the Executive for investigations of this description, and conducted by a Sub-Committee of the Executive, comprising:—

Mr. F. Hammond, F.R.I.B.A., District Surveyor, East Hampstead (Directing Member).
Mr. Ellis Marsland, District Surveyor, Camberwell.
Mr. George Monckton, M.A.

Mr. Thomas Kissack, Resident Engineer at the Testing Station, assisted the Sub-Committee.

Mr. T. E. Leslie Alldridge (Royal Mint), and Mr. H. B. White, M.Inst.E.E., superintended the instrument room.

The Executive was represented by:—

Mr. Edwin O. Sachs (Chairman).
Mr. Max Clarke, A.R.I.B.A.
Mr. Charles E. Goad, M.Am.Soc.C.E.

The Council was represented by:—

Mr. H. H. Collins, F.R.I.B.A., F.S.I., District Surveyor, Eastern Division, City of London.

A number of visitors representing the Press attended by special invitation of the Executive.

Signed,

For the Sub-Committee conducting the Test:
F. HAMMOND.

For the Commercial Section:
FREDERIC R. FARROW.

For the Executive:
EDWIN O. SACHS.

Published by the Committee as directed by the Executive.

GEORGE E. MONCKTON
(Secretary).

Date—November 29th, 1899.

3rd Stage. *2nd Stage.*

BOARDS AFTER TEST.

Publications of the

BRITISH FIRE PREVENTION COMMITTEE.—No. 36.

Edited by Edwin O. Sachs.

FIRE TESTS

WITH

TREATED WOOD.

"NON-FLAMMABLE" WOOD

BY

THE BRITISH NON-FLAMMABLE WOOD COMPANY, Ltd.,

LONDON.

The Committee's Report.

ALL RIGHTS RESERVED.

LONDON, 1899.

PUBLISHED AT THE OFFICES OF

THE BRITISH FIRE PREVENTION COMMITTEE

(Founded, 1897—Incorporated, 1899).

1, WATERLOO PLACE, PALL MALL.

Two Shillings and Sixpence.

(Nett.)

PUBLICATIONS

OF THE

BRITISH FIRE PREVENTION COMMITTEE

No. 1.—WHAT IS FIRE PROTECTION?
No. 2.—AMERICAN OPINIONS ON FIRE PROTECTION.
No. 3.—THE PARIS BAZAAR FIRE.
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No. 8.—FIRE SERVICE IN FACTORIES, WORKS, &c.
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No. 10.—HOW TO BUILD "FIRE-PROOF."
No. 11.—THE TESTS WITH UNPROTECTED COLUMNS.
No. 12.—THE EFFECT OF FIRE.
No. 13.—THE TESTING STATION OF THE B.F.P.C.
No. 14.—OFFICIAL FIRE TESTS WITH FLOORS (No. 1).
No. 15.—CONFLAGRATIONS DURING THE LAST TEN YEARS.
No. 16.—EXPERIMENTAL FIRE TESTS WITH FLOORS (A).
No. 17.—THE TALL BUILDING UNDER TEST OF FIRE.
No. 18.—EXPERIMENTAL FIRE TESTS WITH FLOORS (B).
No. 19.—OFFICIAL FIRE TESTS WITH CEILINGS (No. 2).
No. 20.—OFFICIAL FIRE TESTS WITH GLAZING (No. 3).
No. 21.—EXPERIMENTAL FIRE TESTS WITH FLOORS (C).
No. 22.—EXPERIMENTAL FIRE TESTS WITH PARTITIONS (D & E).
No. 23.—OFFICIAL FIRE TESTS WITH FLOORS (No. 4).
No. 24.—EXPERIMENTAL FIRE TESTS WITH DOORS (G, H, AND I).
No. 25.—EXPERIMENTAL FIRE TESTS WITH DOORS (K AND L).
No. 26.—EXPERIMENTAL FIRE TESTS WITH DOORS (M AND N).
No. 27.—OFFICIAL FIRE TESTS WITH PARTITIONS (No. 7).
No. 28.—OFFICIAL FIRE TESTS WITH CEILINGS (No. 8).
No. 29.—OFFICIAL FIRE TESTS WITH GLASS (No. 5).
No. 30.—OFFICIAL FIRE TESTS WITH GLASS (No. 6).
No. 31.—OFFICIAL FIRE TESTS WITH GLASS (No. 11).
No. 32.—OFFICIAL FIRE TESTS WITH GLASS (No. 12).
No. 33.—EXPERIMENTAL PLAIN GLASS TESTS (O).
No. 34.—EXPERIMENTAL FIRE TESTS WITH FLOORS (P).
No. 35.—EXPERIMENTAL FIRE TESTS WITH DOORS (Q).
No. 36.—OFFICIAL FIRE TESTS WITH TREATED WOOD (No. 9).

Printed by HAZELL, WATSON & VINEY, LD., London and Aylesbury.

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OBJECTS OF THE COMMITTEE:

The main objects of the Committee are :—

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimising the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

To publish from time to time papers specially prepared for the Committee, together with records, extracts, and translations.

To undertake such independent investigations and tests of materials, methods and appliances as may be considered advisable.

The Committee's Reports on Tests with Materials, Methods of Construction, or Appliances are intended solely to state bare facts and occurrences, with tables, diagrams, or illustrations, and they are on no account to be read as expressions of opinion, criticisms, or comparisons.

NOTE.

UP to the present this Committee has only conducted tests in respect to the "fire-resistance" of given materials or systems of construction. To-day, however, a report is also presented that deals solely with the "non-flammability" of a material, which is a very different matter.

The object of the test here discussed was to show that certain boards put before the Committee by the British Non-Flammable Wood Co. would neither spread nor retain flame when in contact with fire. In other words, the patentees wished to show that a material, which generally serves as easy fuel and will rapidly take and spread fire, can be made harmless from a fireman's point of view. The report must, of course, speak for itself on this issue.

My duty in arranging the publication of these reports is not to criticise, but to simply direct attention to any special feature in a test. The characteristic of this test is the novelty of its purpose, *i.e.*, the investigation of the "non-flammability" as distinct from the "fire-resistance" of wood treated by a certain process, and I can but emphasise that this difference of purpose is most important.

As to the application of a "non-flammable" wood, I need hardly add that it aims at fire prevention in the truest meaning of that term.

EDWIN O. SACHS.

LONDON,
September 29th, 1899.

THE GENERAL ARRANGEMENTS FOR TESTS.

(*MEMORANDUM.*)

The purpose of the tests undertaken by the British Fire Prevention Committee is to obtain reliable data as to the exact fire-resistance of the various materials, systems of construction, or appliances used in building practice.

The tests are of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability is assured, records being mostly taken automatically or by photography, and the temperatures being easily regulated by the application of gas.

All reports on tests solely state the bare facts and occurrences, with tables, diagrams and illustrations, and on no account are reports to include expressions of opinion, nor should any expression be read as a comparison or criticism.

The general arrangement and direction of the tests are in the hands of the Executive, who act in accordance with certain principles laid down after careful study and experiment. The official tests are attended by the members of the Council and the members of the Committee in rotation.

As to the Testing Station, it comprises two houses standing in their own grounds near Regent's Park, and backing on to the Regent's Canal. The principal building is used for Committee Rooms and laboratory purposes, whilst the gardens are utilised for so-called "full-size" tests.

As to the financial aspect of the station, the establishment expenses are being met by a special subscription. As far as the funds of the Committee permit, investigations and experimental tests with ordinary (*i.e.*, not patented) forms of construction are undertaken from time to time and duly reported on. Official tests with patented materials, makers' systems, etc., etc., are subject to a scale of charges, but these charges are so figured as to only just cover the actual cost. Any surplus is refunded. The Testing Station is also open to members for such private research work or tests they may desire to undertake.

The services of the members participating in the management of the station, conducting or attending tests, are given entirely gratuitously.

For the Executive,

EDWIN O. SACHS, *Chairman.*

OFFICIAL REPORTS

OF THE

British Fire Prevention Committee.

[FOUNDED, 1897.—INCORPORATED, 1899.]

FIRE TEST No. 9.—JULY 26TH, 1899.

"NON-FLAMMABLE" WOOD,

BY

THE BRITISH NON-FLAMMABLE WOOD CO., Ltd., LONDON.

OBJECT OF TEST.

To record the effect of fire upon "non-flammable" wood (Yellow Pine), particularly to ascertain if boards of non-flammable wood sustain or spread flame *when in contact with fire.*

The procedure of the test was to be as follows:—

(*First Stage*)—The application of flame for five minutes from one side at a temperature of about 500° Fahr.

(*Second Stage*)—The application of flame for ten minutes from the same side, and at approximately the same spot, at a temperature of about 750° Fahr.

(*Third Stage*)—The application of flame for fifteen minutes from the same side, at a second spot, and at a temperature of about 900° Fahr.

Note.—The three stages of the test were to follow at the shortest possible intervals.

Note.—One-inch yellow pine boards were to be used in the form of a partition.

SUMMARY OF EFFECT.

No incandescence or spread of flame was observed, nor did the material, as far as could be seen, contribute in any way to the spread of flame.

The surface of the boards was charred.

Note.—Flame was applied at materially higher temperatures than those specified in the "object of the test." The temperatures rose in the first stage to about 1,000° Fahr.; in the second stage to about 1,150° Fahr.; and in the third stage to about 1,300° Fahr.

DESCRIPTION OF TESTING PLANT.

(See Figs. 1 to 4.)

The Testing Chamber was located at the Committee's Testing Station, and was known as "No. 4 Hut."

The chamber was constructed, as shown, of stock bricks, with lime mortar, and measured 10 ft. by 10 ft. internally.

The soffit of the hut was 8 ft. 3 in. above the pavement of the chamber, and was constructed of concrete, as shown on the sections.

The door-opening was on the north side and measured 2 ft. 3 in. by 6 ft. 6 in.

The fuel used was gas produced at the station, and the supply was regulated by valves and dampers.

A Roberts-Austen pyrometer was used for recording temperatures, eight observation points in all being used, viz.: points 5 and 6 being in the flame, 3 and 7 being in the side walls near the soffit of the hut over the flame 1 and 5 being on a level with the flame on the other side of the partition, and 4 and 8 being near the soffit over Nos. 1 and 5.

There were observation holes, one in the east and one in the west walls, covered by sliding hatches and two small observation holes in the south wall not covered.

The draught holes were in the east and west walls.

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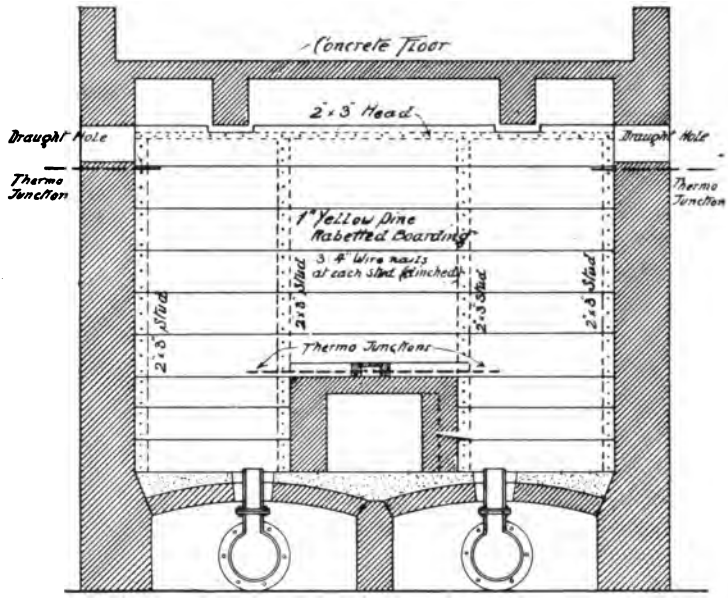
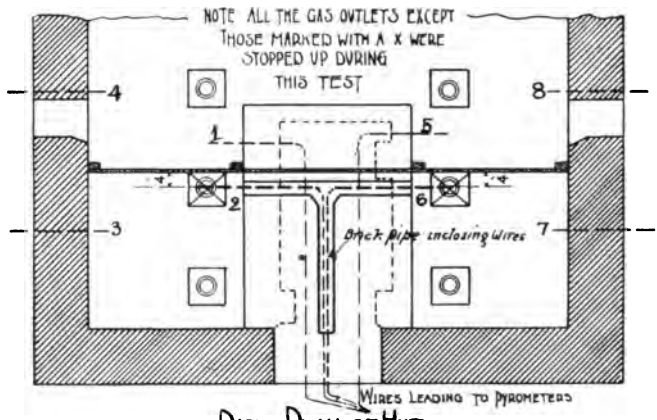


SECTION LOOKING SOUTH



PART PLAN OF HUT.

ARRANGEMENT OF BOARDS. *Figs.* 5 AND 6. PLAN AND ELEVATION.

ARRANGEMENT OF THE BOARDS.

(*See Figs.* 1 *to* 6.)

On July 25th, 1899, the boards were put into position in the form of a partition. The partition ran from east to west, and was 7 ft. 3 in. high, and 10 ft. wide. There were four 2 in. by 3 in. studs ("non-flammable" yellow pine). Two of the studs were nailed to the outside walls, the two intermediate ones rested on the floor; they were the full height of the partition, and were tenoned into a 2 in. by 3 in. yellow pine head, and well nailed; the studs were then covered with 1 in. ("non-flammable" yellow pine) rebated boarding, varying in width from 8 in. to 11 in., there being nine boards in the height.

The boarding was fixed on one side only of the studs—that next the gas outlets. The top of the partition did not extend to the soffit of the concrete roof of the hut. There was an open space of 12 in. between the soffit and the top of the partition.

Each board was nailed to the studs with three 4 in. wire nails, three nails at each stud, and were clinched at the back.

The partition was placed 4 in. from the centre of the gas outlets.

The timber was dry and well seasoned, and was said to have been impregnated with a patented solution, at the London Non-Flammable Wood Company's works at Fulham in the early part of June, 1899, and dried at the laboratory of the British Non-Flammable Wood Company at Battersea.

The boards and studs were delivered at the Testing Station on July 11th, 1899 (*i.e.*, one fortnight before being put into position.

THE TEST.

On Wednesday, July 26th, 1899, the test was undertaken. The following is the log of the test:—

At 3 p.m. the meteorological observations, taken at the Botanic Gardens, Regent's Park, read as follows:—State of weather, cloudy, fine, warm; Wind, W.;

Barometer, 30·19; Attached Thermometer, 75° Fahr.; Dry bulb, 78° Fahr.; Wet bulb, 66° Fahr.

At 3 p.m. the partition was intact.

FIRST STAGE.

At 3.5 p.m. the gas was lighted on the west side, the flame being in contact with the partition.

At 3.10 p.m. the gas was shut off. On examination, no incandescence, flame, spread of flame, or fire could be seen; the surface of the boarding was charred to a depth of about $\frac{1}{16}$ in.

SECOND STAGE.

At 3.15 p.m. the gas was relighted, the flame rising up against the partition and striking against the ceiling, and lapping over the top of the partition.

The following temperatures were recorded from pyrometer points, Nos. 5, 6, 7 and 8 (point No. 6 was in the flame):–

OBSERVATIONS TAKEN AT POINTS NOS. 5, 6, 7 AND 8.
(*From* 3.6 *p.m. to* 3.25 *p.m.*)

	TIME.	Point No 5.	Point No. 6.	Point No. 7.	Point No. 8.
		Fahr.	Fahr.	Fahr.	Fahr.
First Stage	3.6 p.m.	—	350°	525°	425°
	3.8 „	—	1000°	975°	450°
	3.10 „	(Broken)	1075°	1010°	450°
	3.12 „		1000°	825°	215°
	3.16 „		1025°	700°	325°
Second Stage	3.18 „	—	1175°	975°	420°
	3.20 „	—	1210°	1020°	400°
	3.22 „	—	1150°	950°	360°
	3.23 „	—	1180°	960°	360°
	3.24 „	—	1215°	985°	375°
	3.25 „	—	1150°	975°	400°

At 3.18 p.m. the patented solution with which the wood had presumably been treated was exuding from the wood and boiling on the surface.

At 3·25 p.m. the gas was shut off on the western side.

THIRD STAGE.

At 3.25 p.m. the gas was lighted on the eastern side, the flame rising up against the partition to the soffit of the concrete roof as in the former case.

The following temperatures were recorded from pyrometer points, Nos. 1, 2, 3, 4 (point No. 2 was in the flame).

OBSERVATIONS TAKEN AT POINTS, 1, 2, 3, AND 4.

(*From* 3.26 *p.m to* 3.34 *p.m.*)

	TIME.	Point No. 1.	Point No. 2.	Point No. 3.	Point No. 4.
		Fahr.	Fahr.	Fahr.	Fahr.
Third Stage.	3.26 p.m.	—	450°	425°	325°
	3.28 „	—	1125°	425°	330°
	3.30 „	—	1235°	565°	400°
	3.32 „	150°	1300°	675°	485°
	3.34 „	150°	1310°	735°	510°

At 3.35½ p.m. the gas was shut down. On examination, no incandescence or spread of flame was observed on any part of the partition.

This concluded the test.

OBSERVATIONS AFTER THE TEST.

(*Figs.* 7, 8 *and* 9.)

On July 27th, photographs were taken (*see* Figs. 7, 8 and 9). On Monday, July 31st, 1899, the partition was examined.

The lower boards were found to be charred to a depth of $\frac{1}{16}$ in., the charring then increasing in the upper

BOARDS AFTER TEST. *Fig.* 7. VIEW OF FIRE SIDE (SHOWING PART DEALT WITH IN THE FIRST AND SECOND STAGES).
(Flash-light Photograph.)

BOARDS AFTER TEST. *Fig.* 8. VIEW OF FIRE SIDE (SHOWING PART DEALT WITH IN THIRD STAGE).
(Flash-light Photograph.)

boards. The upper edge of the top board was charred through its thickness where the flame struck the ceiling and lapped over the partition.

No further observations were made.

GENERAL ARRANGEMENTS.

The Test was carried out in accordance with the procedure laid down by the Executive for investigations of this description, and conducted by a Sub-Committee of the Executive, comprising :—

Mr. Max Clarke, A.R.I.B.A. (Directing Member).

Mr. F. Hammond, F.R.I.B.A., District Surveyor, East Hampstead, &c.

Mr. Ellis Marsland, District Surveyor, Camberwell.

Mr. Thomas Kissack, Resident Engineer at the Testing Station, assisted the Sub-Committee.

Mr. T. E. Leslie Alldridge (Royal Mint) superintended the Instrument Room.

The Council was represented by :

Mr. Thomas Blashill, F.R.I.B.A., F.S.I., late Architect to the London County Council.

Sir John Taylor, K.C.B., H.M. Office of Works.

The Executive was represented by :

Edwin O. Sachs (Chairman).

Mr. Robert Mond, M.A., F.R.S.E.

Mr. Edmund Woodthorpe, M.A., F.R.I.B.A., District Surveyor, Northern Division, City.

The Members' Testing Sub-Committee was represented by :

Mr. George E. Monckton, M.A.

The General Body of Members was represented by :

Mr. S. Flint Clarkson, F.R.I.B.A., District Surveyor, Chelsea.

Mr. R. P. Notley, F.R.I.B.A., F.S.I., District Surveyor, Bethnal Green.

Mr. W. White, F.S.A.

The British Non-Flammable Wood Company was represented by:

Messrs. E. Marshal Fox, S. Evershed, A. J. Greenop, and Charles Howard.

The following visitors attended by special invitation of the Executive:

Admiral Sir H. H. Nicholson, K.C.B.
Mr. O. B. Leitch (Assistant Director of Works, Admiralty).
Lieut. P. S. Greig, R.E. (War Office).
Mr. F. S. Capon (Factories and Workshops Branch, London County Council).
Major E. Palliser.
Captain G. McArthur, R.N.
Mr. C. V. Childs.
Mr. J. F. Golding.
Mr. Egan Hill (Messrs. Williamson, Hill & Co., Solicitors to the Committee).
Mr. J. D. O'Brien.
Mr. George Pritchard.
Mr. Thomas Rowe.

Signed,

For the Sub-Committee conducting the Test:
MAX CLARKE.

For the Commercial Section:
FRED. R. FARROW.

For the Executive:
EDWIN O. SACHS.

Published by the Committee as directed by the Executive.
GEORGE E. MONCKTON
(Secretary).
Date—2nd October, 1899.

Verified a true copy of the Report ordered to be published.
WILLIAMSON, HILL & Co.
(Solicitors).
Date—9th October, 1899.

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THE PARTITION. *Fig.* 6. VIEW FROM INSIDE AFTER TEST.

Publications of the

BRITISH FIRE PREVENTION COMMITTEE.—No. 37.

Edited by Edwin O. Sachs.

FIRE TESTS WITH PARTITIONS.

A PARTITION

ERECTED BY

THE "GYPSINE" BRICK COMPANY,

LONDON & PARIS.

The Committee's Report.

ALL RIGHTS RESERVED.

LONDON, 1900.

PUBLISHED AT THE OFFICES OF
THE BRITISH FIRE PREVENTION COMMITTEE
(Founded, 1897—Incorporated, 1899),
1, WATERLOO PLACE, PALL MALL.

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No. 34.—EXPERIMENTAL FIRE TESTS WITH FLOORS (R).
No. 35.—EXPERIMENTAL FIRE TESTS WITH DOORS (S AND T).
No. 36.—OFFICIAL FIRE TESTS WITH TREATED WOOD (No. 9)

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OBJECTS OF THE COMMITTEE:

The main objects of the Committee are:—

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimising the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

To publish from time to time papers specially prepared for the Committee, together with records, extracts, and translations.

To undertake such independent investigations and tests of materials, methods and appliances as may be considered advisable.

The Committee's Reports on Tests with Materials, Methods of Construction, or Appliances are intended solely to state bare facts and occurrences, with tables, diagrams, or illustrations, and they are on no account to be read as expressions of opinion, criticisms, or comparisons.

NOTE.

The report presented in this publication deals with a partition erected by the "Gypsine" Brick Company, Limited, of London and Paris.

The report may be taken to speak for itself, and if there is anything I should like to refer to in this test, I think it would be to draw attention to the note in the "Summary of Effect" that the wood beams forming the ceiling of the testing hut transmitted the fire from the testing chamber proper to the passage on the outside of the partition, and that an increase in the temperature in the passage was due to this occurrence.

Exact details as regards the composition of the bricks used were not given, the materials of which these bricks might be composed alone being named by the maker. As we have here a case where the exact composition and proportion of the substances used in the manufacture of the bricks must affect their fire-resistance, it is regretable that the details were not given. It makes it so much more difficult for the architect to know whether the bricks put on the market are identical with those which have been under investigation.

It might be of interest to add that the bricks are a German invention exploited in France, and the owners of the English patents resident in France are commencing their business operations in this country by first having their materials tested under the auspices of this Committee.

EDWIN O. SACHS.

LONDON,

January 7th, 1900.

THE GENERAL ARRANGEMENTS FOR TESTS.

(MEMORANDUM.)

The purpose of the tests undertaken by the British Fire Prevention Committee is to obtain reliable data as to the exact fire-resistance of the various materials, systems of construction, or appliances used in building practice.

The tests are of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability is assured, records being mostly taken automatically or by photography, and the temperatures being easily regulated by the application of gas.

All reports on tests solely state the bare facts and occurrences, with tables, diagrams and illustrations, and on no account are reports to include expressions of opinion, nor should any expression be read as a comparison or criticism.

The general arrangement and direction of the tests are in the hands of the Executive, who act in accordance with certain principles laid down after careful study and experiment. The official tests are attended by the members of the Council and the members of the Committee in rotation.

As to the Testing Station, it comprises two houses standing in their own grounds near Regent's Park, and backing on to the Regent's Canal. The principal building is used for Committee Rooms and laboratory purposes, whilst the gardens are utilised for so-called "full-size" tests.

As to the financial aspect of the station, the establishment expenses are being met by a special subscription. As far as the funds of the Committee permit, investigations and experimental tests with ordinary (*i.e.*, not patented) forms of construction are undertaken from time to time and duly reported on. Official tests with patented materials, makers' systems, etc., etc., are subject to a scale of charges, but these charges are so figured as to only just cover the actual cost. Any surplus is refunded. The Testing Station is also open to members for such private research work or tests they may desire to undertake.

The services of the members participating in the management of the station, conducting or attending tests, are given entirely gratuitously.

For the Executive,

EDWIN O. SACHS, *Chairman.*

THE PARTITION. *Fig. 7.* VIEW FROM OUTSIDE AFTER TEST.

OFFICIAL REPORTS

OF THE

British Fire Prevention Committee.

[FOUNDED, 1897.—INCORPORATED, 1899.]

FIRE TEST No. 14.—15TH NOVEMBER, 1899.

A PARTITION

ERECTED BY

THE "GYPSINE" BRICK COMPANY, LTD.,

LONDON AND PARIS.

OBJECT OF TEST.

To record the effect of a fire of one hour's duration, commencing at 500° Fahr. and increasing to 1,800° Fahr., followed by the application of water for two minutes on the fire side.

Note: The area of the partition under investigation was to be at least 75 ft. superficial, with a width of 10 ft.

Note: The time allowed for the construction and drying of the partition was to be a fortnight (Autumn).

SUMMARY OF EFFECT.

A portion of the coating of fire-clay on the fire side of the partition fell during the application of heat.

A further portion fell off on the application of water, as also most of the fire-clay pointing to the joints.

In no place had the fire passed through the partition.

The bricks were sodden with water and easily impressed, although no effects of the fire were apparent except for some hair cracks on the fire side.

The temperature of the outside face of the partition was at no time sufficient to ignite a match.

Note: – Flame spread over the top of the partition by means of the wood beams forming the ceiling of the hut, these beams being so laid as to cover both the chamber and the passage. This increased the temperature on the outside of the partition (in passage).

DESCRIPTION OF TESTING PLANT.

(See Figs. 1 to 4.)

The Testing Chamber used was located at the Committee's Testing Station, and was known as "No. 4 Hut."

The hut was constructed, as shown, of stock bricks with lime mortar, and measured 10 ft. by 10 ft. internally.

The ceiling was 7 ft. 8 in. above the pavement of the hut, and was constructed of wood beams.

The hut was covered in with a tarpaulin.

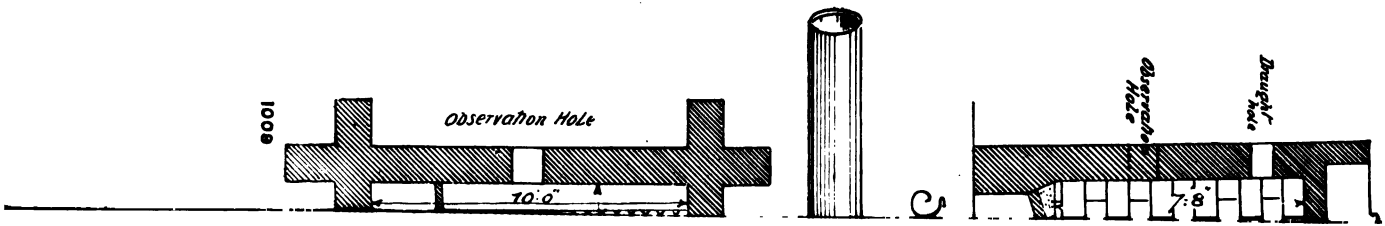
The door-opening in the north wall measured 2 ft. by 6 ft. 6 in., and was open during the test.

The fuel used was gas produced at the station, and the supply was regulated by valves and dampers.

The hut was divided as shown on plan, the partition being constructed from east to west, the full width and height of the hut, leaving a passage on the outside 2 ft. wide.

The gas was admitted through two mixing chambers of fire-brick, each 7 ft. 9 in. by 3 ft. 6 in. as shown.

Two Roberts-Austen pyrometers were used for recording temperatures, one taking a continuous record from point No. 5 and one being used for the observation records at points Nos. 1, 2, 3, 4. Points Nos. 1, 4, 5, were in the chamber, and Nos. 2 and 3 outside in the passage.


1000
Observation Hole
10'0"
Observation Hole
Draught Hole
7'8"

There were two observation holes, one in the east and one in the west walls, and two small observation holes in the south wall.

The stream of water was applied to the inside face of partition, through the observation hole on the west side, by a branch with ½ in. nozzle, and supplied from a manual fire engine similarly equipped.

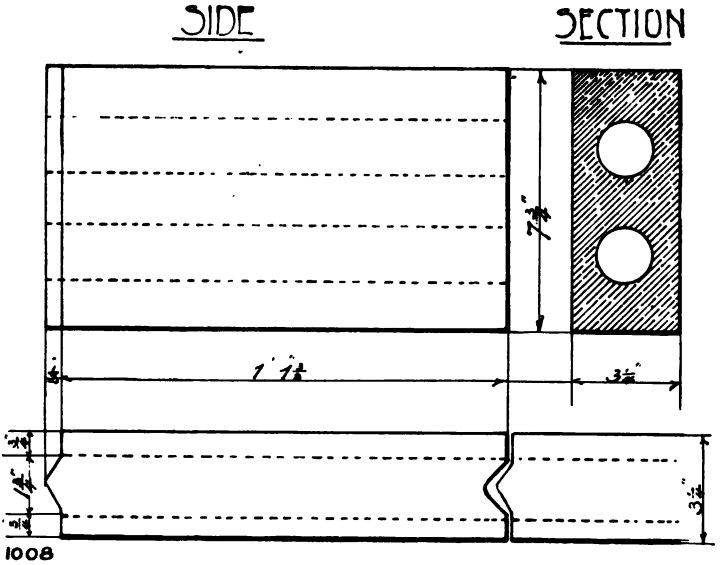


Fig. 5. Detail of Brick forming Partition.

CONSTRUCTION OF THE PARTITION.

(*See Figs. Nos.* 1 *to* 5.)

Plans, elevations and sections of the partition are shown.

The construction of the partition was as follows:—

On October 30th the partition was erected; it ran east and west and was set back from the north wall two feet, so that the internal dimensions of the chamber during the test were 7 ft. 9 in. by 10 ft. The partition was built from floor to ceiling and 11 courses in height, or 7 ft.

8 in., and was laid on a single course of stock bricks bedded in cement on the floor.

The bricks of which the partition was constructed were 13⅜ in. long, 7¾ in. deep, and 3¼ in. thick; each brick had two circular holes 1⅝ in. diameter running horizontally through it. (*See Fig.* 5).

The manufacturer gave the following specification of the composition of the bricks:—

"A mixture, by means of water, of plaster, hydraulic lime, some sort of neutral material, such as coke, sand, etc., and a fire-proof material, such as asbestos with an addition of sulphuric acid."

The bricks were laid in mortar composed of hydraulic lime, and sand, the joints being ¼ in. thick.

On November 2nd the joints of bricks on the inside of hut, or that side towards the fire, were raked out to a depth of ⅜ in. and filled in with fire-clay, and the whole surface of the wall on the fire side was covered with a thin coating of the same material. The partition was then allowed to stand until the 15th of November, when the test was undertaken.

The weather report on October 30th, when the partition was erected, was as follows:—

State of weather, cloudy; Wind, W.N.W.; Rain, none; Barometer, 29·80 ins.; Attached Thermometer, 56° Fahr.; Dry bulb, 50° Fahr.; Wet bulb, 46° Fahr.; Remarks, fine, fresh air.

THE TEST.

On November 15th the test was undertaken. The following is a log of the test:—

At 3 p.m. the meteorological observations, taken at the Botanic Gardens, Regent's Park, read as follows:—

State of weather, overcast; Wind, E.N.E.; Barometer, 30·52 in.; Attached Thermometer, 50° Fahr.; Wet bulb, 47·8° Fahr.; Dry bulb, 50° Fahr. Remarks, dull but fine afternoon.

At 3.42 p.m. the gas was lighted.

At 4.10 p.m. the upper part of partition on passage side was too hot to bear the hand.

At 4.25 p.m. the upper and lower parts of partition on passage side were too hot to bear the hand.

At 4.35 p.m. the fire-clay coating on the upper part of the west side of partition fell off in flakes.

Note.—At 4.40 p.m. the wooden beams forming ceiling to hut became ignited on passage side.

At 4.40 p.m. the head of a wax match was held against the outside of the partition in several places, but it failed to ignite.

At 4.42 p.m. the gas was turned off. The partition was intact, the fire not having passed through it, and the surface on the passage side was unaffected by the fire.

At 4.43 water was turned on to the inside face of the partition for two minutes at 20 lbs. pressure.

The effect of this was to wash off the remains of the coating of fire-clay where struck by the water, but no other effect was apparent.

Note:—On November 15th, after the test, the ceiling being still incandescent, water was applied intermittently for several hours.

The temperatures, as read from the observation record off pyrometer points Nos. 1, 2, and 4, were as follows:—

OBSERVATIONS TAKEN FROM POINTS NOS. 1, 2, 3 AND 4.

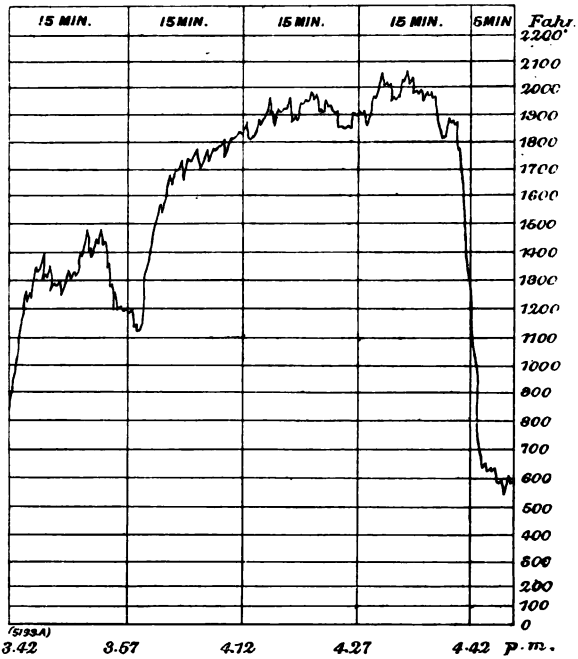
From 3.45 *p.m. to* 4.50 *p.m.*

	OUTSIDE (in passage).		INSIDE.	
TIME.	No. 3. Fahr.	No. 2. Fahr.	No. 1. Fahr.	No. 4. Fahr.
3.45 p.m.	—	—	1,000°	1,175°
3.48 „	—	—	1,200°	1,300°
3.52 „	—	—	1,275°	1,410°
3.55 „	—	—	1,300°	1,420°
3.58 „	—	120°	1,040°	1,150°
4.1 „	—	150°	1,100°	1,350°
4.4 „	—	200°	1,480°	1,675°
4.7 „	—	200°	1,560°	1,720°
4.10 „	—	210°	1,640°	1,760°
4.13 „	—	200°	1,680°	1,800°
4.16 „	—	260°	1,730°	1,850°
4.19 „	—	275°	1,750°	1,900°
4.22 „	—	300°	1,800°	1,900°
4.25 „	—	320°	1,840°	1,875°
4.28 „	—	440°	1,820°	1,830°
4.31 „	—	470°	1,840°	1,900°
4.34 „	—	580°	1,880°	1,950°
4.37 „	—	650°	1,900°	1,875°
4.40 „	—	650°	1,730°	1,740°
4.43 „	—	620°	1,500°	1,460°
4.47 „	—	520°	320°	900°
4.50 „	—	450°	300°	700°

Note.—During the test no temperature was recorded from point No. 3, in the passage, as the wire was accidentally put out of order.

Note.—Flame spread over the top of the partition by means of the wood beams forming the ceiling to the hut, these beams being so laid as to cover both the chamber and the passage. This increased the temperature on the outside of the partition (in passage).

The temperature, as shown by the automatic record point 5 (inside), is as follows :—



OBSERVATIONS AFTER TEST.

(*Figs. Nos.* 6 *and* 7).

On November 16th the photographs were taken.

On November 16th the following observations were made :—

The fire-clay coating on the inside face of the partition, where the water had played upon it, was washed away, as also most of the fire-clay pointing to the joints of the bricks.

The bricks forming the partition had absorbed a good deal of water, and were soft and sodden and easily impressed.

Fine hair cracks appeared on the surface inside.

In no place had the fire passed through the partition.

The outside of the partition next to the passage was quite intact, it was sodden and easily impressed but no effects of the fire were apparent.

GENERAL ARRANGEMENTS.

The test was carried out according to the procedure laid down by the Executive for investigations of this description, and conducted by a Sub-Committee of the Executive, comprising :—

Mr. Ellis Marsland, District Surveyor, Camberwell (Directing Member).

Mr. Chas. E. Goad, M. Am. Soc. C.E.

Mr. F. Hammond, F.R.I.B.A., District Surveyor, East Hampstead.

Mr. Thomas Kissack, Resident Engineer at the Testing Station, assisted the Sub-Committee.

Mr. H. B. White, M.I.E.E., superintended the instrument room.

The Executive was represented by :—

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Mr. Max Clarke, A.R.I.B.A.

The Commercial Section was represented by :—

Mr. Frederic R. Farrow, F.R.I.B.A.

The Members' Testing Sub-Committee was represented by :—

Mr. George E. Monckton, M.A.

The general body of members was represented by :—

Mr. L. E. Aulagnier.

Mr. J. Buley, C.E.

Mr. H. Busbridge.

Mr. C. F. Hayward, F.S.A., F.R.I.B.A., District Surveyor, Bloomsbury.

Mr. E. R. Hewitt, A.R.I.B.A., District Surveyor, Southwark.
Mr. Lowe, F.S.I., Vestry Surveyor, Hampstead.
Mr. G. McDonell, A.R.I.B.A., District Surveyor, St. Luke's.
Mr. J. R. Manning, M.S.A.
Mr. S. F. Monier-Williams, District Surveyor, Fulham (South).
Mr. R. P. Notley, F.R.I.B.A., F.S.I., District Surveyor, Bethnal Green.
Mr. J. Tolley.
Mr. W. Waine.
Mr. T. Wilkins, F.G.S.

The Gypsine Brick Co., Ltd., was represented by:
Messrs. Herbst, Ed. Kelly and E. Thurnysen.

The following visitors attended by special invitation of the Executive:

Herr Muthesius, Technical Attaché to the German Embassy.
Monsieur le Capitaine Welsch, Commandant des Sapeurs-Pompiers, Ghent.
Mr. T. Sims (Admiralty).
Mr. Sydney R. J. Smith, F.R.I.B.A., F.S.I.
Mr. J. Howard Colls.
Mr. C. A. Balph.
Mr. J. D. O'Brien.
Mr. W. J. Delbridge.
Mr. J. F. Golding.
Major F. de C. Helbert.
Mr. W. Markham.
Mr. E. C. Pilkington.

Signed,

For the Sub-Committee conducting the test:

ELLIS MARSLAND (*Directing Member*).

For the Commercial Section:

FREDERIC R. FARROW.

For the Executive:

EDWIN O. SACHS (*Chairman*).

Published by the Committee as directed by the Executive.

GEORGE E. MONCKTON (*Secretary*).

Date—December 14th, 1899.

Verified a true copy of the Report ordered to be published.

WILLIAMSON, HILL & CO. (*Solicitors.*)

Date—January 9th, 1900.

THE FLOORING. *Fig.* 5. VIEW AFTER TEST (FROM ABOVE).

Publications of the

BRITISH FIRE PREVENTION COMMITTEE.—No. 38.

Edited by Edwin O. Sachs.

FIRE TESTS WITH FLOORS.

A FLOOR

BY

THE "GYPSINE" BRICK COMPANY, LTD.,

LONDON AND PARIS.

The Committee's Report.

LONDON, 1900.

PUBLISHED AT THE OFFICES OF
THE BRITISH FIRE PREVENTION COMMITTEE
(Founded 1897—Incorporated 1899).
1, WATERLOO PLACE, PALL MALL.

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1, WATERLOO PLACE, PALL MALL, LONDON, S.W.

OBJECTS OF THE COMMITTEE.

The main objects of the Committee are:—

To direct attention to the urgent need for increased protection of life and property from fire by the adoption of preventive measures.

To use its influence in every direction towards minimising the possibilities and dangers of fire.

To bring together those scientifically interested in the subject of Fire Prevention.

To arrange periodical meetings for the discussion of practical questions bearing on the same.

To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

To publish from time to time papers specially prepared for the Committee, together with records, extracts and translations.

To undertake such independent investigations and tests of materials, methods and appliances as may be considered advisable.

The Committee's Reports on Tests with Materials, Methods of Construction, or Appliances are intended solely to state bare facts and occurrences, with tables, diagrams, or illustrations, and they are on no account intended to read as expressions of opinion, criticisms, or comparisons.

NOTE.

The report here presented should be read in connection with the one put forward in the preceding publication, dealing with a partition erected by the same makers.

As in the former case, the report speaks for itself, and if there is any point to which I should like to call attention, it is the fact that the floor, or rather piece of flooring under investigation, comprised a slab covering an opening 10 ft. by 3 ft. 6 in. clear, and resting on the $4\frac{1}{2}$ in. offset of the surrounding brick walls. All composite floors tested previously comprised a combination of wood or iron joists with concrete, covering an opening of 10 ft. by 10 ft.

The test might perhaps be more properly termed a test with a flooring, a flooring material, or the span of a floor, rather than with a floor as generally understood in this series of investigations.

EDWIN O. SACHS.

LONDON,

February 26th, 1900.

THE GENERAL ARRANGEMENTS FOR TESTS.

(MEMORANDUM.)

The purpose of the tests undertaken by the British Fire Prevention Committee is to obtain reliable data as to the exact fire-resistance of the various materials, systems of construction, or appliances used in building practice.

The tests are of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability is assured, records being mostly taken automatically or by photography, and the temperatures being easily regulated by the application of gas.

All reports on tests solely state the bare facts and occurrences, with tables, diagrams and illustrations, and on no account are reports to include expressions of opinion, nor should any expression be read as a comparison or criticism.

The general arrangement and direction of the tests are in the hands of the Executive, who act in accordance with certain principles laid down after careful study and experiment. The official tests are attended by the members of the Council and the members of the Committee in rotation.

As to the Testing Station, it comprises two houses standing in their own grounds near Regent's Park, and backing on to the Regent's Canal. The principal building is used for Committee Rooms and laboratory purposes, whilst the gardens are utilised for so-called "full-size" tests.

As to the financial aspect of the station, the establishment expenses are being met by a special subscription. As far as the funds of the Committee permit, investigations and experimental tests with ordinary (*i.e.*, not patented) forms of construction are undertaken from time to time and duly reported on. Official tests with patented materials, makers' systems, etc., etc., are subject to a scale of charges, but these charges are so figured as to only just cover the actual cost. Any surplus is refunded. The Testing Station is also open to members for such private research work or tests they may desire to undertake.

The services of the members participating in the management of the station, conducting or attending tests, are given entirely gratuitously.

For the Executive,

EDWIN O. SACHS, *Chairman.*

OFFICIAL REPORT

OF THE

British Fire Prevention Committee.

[FOUNDED 1897.—INCORPORATED 1899.]

FIRE TEST No. 13.—NOVEMBER 15TH, 1899.

A FLOOR

BY

THE "GYPSINE" BRICK COMPANY, LTD.,

LONDON AND PARIS.

OBJECT OF TEST.

To record the effect of a fire of one hour's duration with a temperature commencing at about 300° Fahr, running gradually up to 1,800° Fahr. At the expiration of one hour, water was to be applied for two minutes on the heated side. The weight on the floor, to be distributed over the whole surface, was 168 lbs. per square foot.

Note.—The superficial area of the flooring under investigation was to be 35 ft., namely, 10 ft. by 3 ft. 6 in.

The time to be allowed for construction and drying was to be a month. (Autumn).

SUMMARY OF EFFECT.

In 27 minutes small flakes dropped off the soffit in places, and the upper surface was quite cool to the touch.

In 34 minutes further small flakes dropped from the soffit, and a longitudinal crack, about 5 ft. long, appeared.

In 59 minutes, when the gas was shut off, the soffit appeared red hot, and vapour was observed to be

issuing through cracks in the upper surface and from the stack of bricks forming the load.

After the test, and the load had been removed, cracks surrounding the floor were observed, as well as the longitudinal crack referred to above. The cracks were fairly open in places to the extent of about $\frac{1}{8}$ inch; these cracks went obliquely through the floor and appeared as hair cracks on the soffit. The floor towards one end had sunk in the centre about $1\frac{1}{4}$ inch.

Several transverse cracks were also observed from below, besides the longitudinal crack referred to above.

The material of which the floor was composed, when broken for examination crumbled away at the touch.

DESCRIPTION OF TESTING PLANT.

(See Figs. 1 to 4).

The Testing Chamber was located at the Committee's Testing Station, and was a portion of "No. 1 Hut."

The hut was constructed, as shown, of stock bricks with lime mortar, and the chamber measured 10 ft. by 3 ft. 6 in. internally.

The flooring rested on the brick set-off on the top of the chamber. (See section)

The soffit of the flooring was 8 ft. above the pavement of the chamber.

The fuel used was gas produced at the station, and the supply was regulated by valves and dampers.

The gas was admitted through a mixing chamber of fire-brick, as shown.

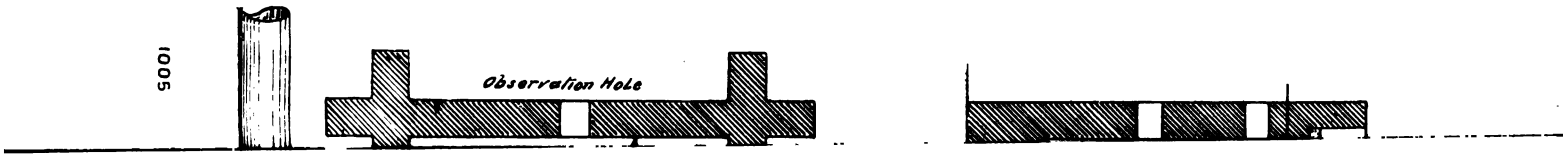
Two Roberts-Austen pyrometers were used for recording temperatures, to take four observation records from points 1, 2, 3, 4.

There was one observation hole in the east wall covered by a sliding hatch.

The ventilation holes were in the east wall.

The photograph was taken by daylight.

The stream of water was applied through a branch with $\frac{1}{2}$ inch nozzle, equipped with a pressure gauge, and supplied from a manual fire engine similarly equipped.


1005
Observation Hole

CONSTRUCTION OF THE FLOOR.

(See Figs. 1 to 4*).*

A plan and section is shown.

The mode of construction of the floor was as follows :—

On October 14th the centering for the floor was put up.

On October 16th the floor was constructed 4 inches thick.

Four pieces of hoop-iron (1 in. by $\frac{1}{16}$th in.) were laid on edge across the chamber at irregular intervals (from east to west).

The manufacturer gave the following specification of the composition of the flooring :—

" A mixture, by means of water, of plaster, hydraulic lime, some sort of neutral material, such as coke, sand, etc., and a fire-proof material, such as asbestos, with an addition of sulphuric acid."

The material was mixed in a large tub on the top of the hut and while in a liquid state was emptied on to the centering. The entire surface of the centering was previously covered with oiled paper.

At the expiration of fifteen minutes after the material was put on, the centering was taken down, and the floor was allowed to stand until the 15th of November, when the Test was undertaken.

The hut was covered in with a tarpaulin, which was, however, removed on fine days.

On Tuesday, November 14th, the floor was loaded with bricks to the extent of 168 lbs. per square foot.

THE TEST.

On Wednesday, November 15th, the test was undertaken. The following is the log of the Test :—

Note.—At 3 p.m. the meteorological observations taken at the Botanic Gardens, Regent's Park, read as follows :—State of weather, overcast; Rain, none; Wind,

E.N.E.; Barometer, 30·52 ins.; Attached Thermometer, 50° Fahr.; Dry Bulb, 50° Fahr.; Wet Bulb, 47·8° Fahr.; Remarks, Fine afternoon.

The following temperatures were taken from points Nos. 1, 2, 3 and 4 :—

OBSERVATIONS TAKEN AT POINTS.

Nos. 1, 2, 3, 4, *from* 1.32 *p.m. to* 2.29 *p.m.*

FIRST TEST, 15TH NOV., 1899.

HUT NO. 1.

TIME.	No. 1.	No. 2.	No. 3.	No. 4.
	Fahr.	Fahr.	Fahr.	Fahr.
1.32 p.m.	275°	260°	350°	620°
1.35 ,,	650°	730°	740°	915°
1.38 ,,	720°	775°	780°	930°
1.41 ,,	850°	900°	900°	1,110°
1.44 ,,	910°	1,000°	1,000°	1,200°
1.47 ,,	1,150°	1,200°	1,200°	1,340°
1.50 ,,	1,320°	1,350°	1,310°	1,410°
1.53 ,,	1,430°	1,430°	1,370°	1,500°
1.56 ,,	1,410°	1,400°	1,400°	1,510°
1.59 ,,	1,410°	1,405°	1,400°	1,550°
2.2 ,,	1,510°	1,500°	1,495°	1,575°
2.5 ,,	1,480°	1,480°	1,480°	1,600°
2.8 ,,	1,500°	1,490°	1,500°	1,600°
2.11 ,,	1,540°	1,540°	1,550°	1,650°
2.14 ,,	1,600°	1,560°	1,560°	1,675°
2.17 ,,	1,600°	1,550°	1,560°	1,680°
2.20 ,,	1,600°	1,600°	1,600°	1,700°
2.23 ,,	1,650°	1,640°	1,650°	1,750°
2.26 ,,	1,700°	1,680°	1,510°	1,760°
2.29 ,,	1,680°	1,650°	1,510°	1,800°

At 1.31 p.m. the gas was turned on and lighted.

At 1.46 p.m. the upper surface of floor was quite cool to the touch.

At 1.58 p.m. small flakes dropped from the soffit in several places; the upper surface was quite cool to the touch. Several sharp cracking sounds were heard emanating from the floor under investigation.

At 2.5 p.m. further flakes dropped from the soffit and a longitudinal crack appeared near the centre, running from north to south, about half the entire length of the floor. Also a slight indentation was observable in one corner.

At. 2.21 p.m. the crack widening.

At 2.30 p.m. the gas was shut off. The soffit appeared red hot.

At 2.32 p.m. water was applied through the observation and draught holes on to the soffit, the pressure gauge at the manual registering 25 lbs.

At 2.34 p.m. the water was shut down and the test closed, when vapour was observed issuing from cracks in the upper surface, and through the stack of bricks forming the load.

OBSERVATIONS AFTER THE TEST.

(*Figs.* 5 *and* 6).

On November 16th the photograph was taken, after the weight had been removed.

On November 16th, at 3.40 p.m., an examination was made of the floor, which was standing in situ.

The floor towards the south end had sunk in the centre for about $1\frac{1}{4}$ in.

The upper surface was cracked at the north end all across and very irregularly, at an average of about 6 in. from the wall.

A similar crack extended on the west side, the entire length from north to south, close to the wall in places, and in one or two points $2\frac{1}{2}$ in. and $6\frac{1}{2}$ in. from the face of the wall respectively.

A similar crack extended the entire length of the south end about an average distance of $2\frac{1}{2}$ in. from the face of the wall.

On the east side the floor had drawn away from the wall, showing a crack for a length of about 7 ft. A crack also existed in the centre of the depression and running north and south.

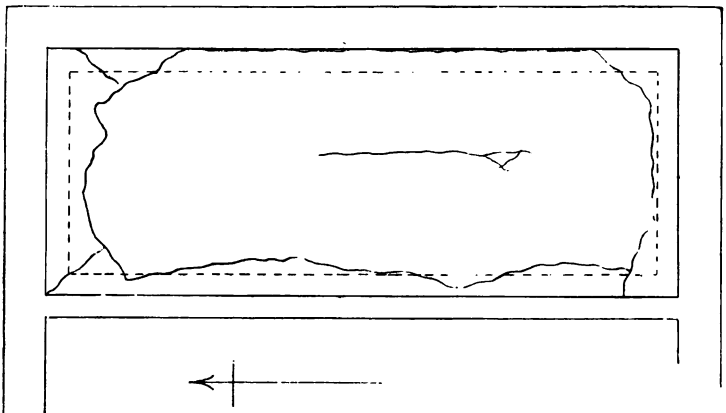
The whole of the foregoing cracks were fairly open in several places to the extent of about $\frac{1}{8}$ in.; these cracks went obliquely through the floor and appeared as hair cracks on the soffit.

Several transverse cracks were also observed from below, besides the longitudinal crack referred to above.

On November 16th the floor was broken down.

The material of which the floor was composed, when broken for examination, crumbled away at the touch.

No further observations were made.



1014 THE FLOOR. *Fig.* 6. SKETCH SHOWING CRACKS ON TOP AFTER TEST AND REMOVAL OF LOAD.

GENERAL ARRANGEMENTS.

The test was carried out in accordance with the procedure laid down by the Executive for investigations of this description, and conducted by a sub-Committee of the Executive, comprising :—

Mr. F. Hammond, F.R.I.B.A., District Surveyor, East Hampstead (Directing Member).

Mr. Robert Mond, M.A., F.R.S.E.

Mr. Max Clarke, A.R.I.B.A.

Mr. Thomas Kissack (Resident Engineer at the Testing Station), assisted the Sub-committee.

Mr. H. B. White, M.I.E.E., superintended in the instrument room.

The Council was represented by :—

Mr. Arthur Cates, late Surveyor, Crown Estates.

Mr. H. Gundry, F.R.I.B.A., President District Surveyors' Association.

The Executive was represented by :—

Mr. Edwin O. Sachs (Chairman).

Mr. Chas. E. Goad, M.Am.Soc.C.E.

Mr. Ellis Marsland, District Surveyor, Camberwell.

The Commercial Section was represented by :—

Mr. Frederic R. Farrow, F.R.I.B.A.

The Members' Testing Sub-Committee was represented by :—

Mr. George E. Monckton, M.A.

The general body of members was represented by :—

Mr. L. E. Aulagnier.

Mr. J. Buley.

Mr. H. Busbridge.

Mr. C. F. Hayward, F.S.A., F.R.I.B.A., District Surveyor, Bloomsbury.

Mr. E. R. Hewitt, A.R.I.B.A., District Surveyor, Southwark.

Mr. Lowe, M. Inst. C.E., F.S.I., Vestry Surveyor, Hampstead.

Mr. G. McDonell, A.R.I.B.A., District Surveyor, St. Lukes.

Mr. J. R. Manning, M.S.A.

Mr. S. F. Monier-Williams, District Surveyor, Fulham.

Mr. R. P. Notley, F.R.I.B.A., F.S.I., District Surveyor, Bethnal Green.

Mr. J. Tolley.

Mr. W. Waine.
Mr. T. Wilkins, F.G.S.

The following visitors attended by special invitation of the Executive:—

Herr Muthesius Technical Attaché to the German Embassy).
Monsieur le Capitaine Welsch (Commandant des Sapeurs-Pompiers, Ghent).
Mr. T. Sims (Admiralty).
Mr. Sidney R. J. Smith, F.R.I.B.A., F.S.I.
Mr. J. Howard Colls.
Mr. C. A. Balph.
Mr. J. D. O'Brien.
Mr. W. J. Delbridge.
Mr. J. C. Golding.
Major J. de C. Helbert.
Mr. W. Markham.
Mr. E. C. Pilkington.

The Gypsine Brick Co., Limited, was represented by :—
Messrs. Herbst, Edmond Kelly and E. Thurnysen.

Signed,

For the Sub-Committee conducting the Test:
F. HAMMOND (*Directing Member*).

For the Commercial Section:
FREDERIC R. FARROW.

For the Executive:
EDWIN O. SACHS (*Chairman*).

Published by the Committee as directed by the Executive.
GEORGE E. MONCKTON
(Hon. Secretary).

Date—29*th January*, 1900.

Verified a true copy of the Report, ordered to be published.
WILLIAMSON, HILL & Co.
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Date—*February* 24*th*, 1900.

(Founded 1897—Incorporated 1899),

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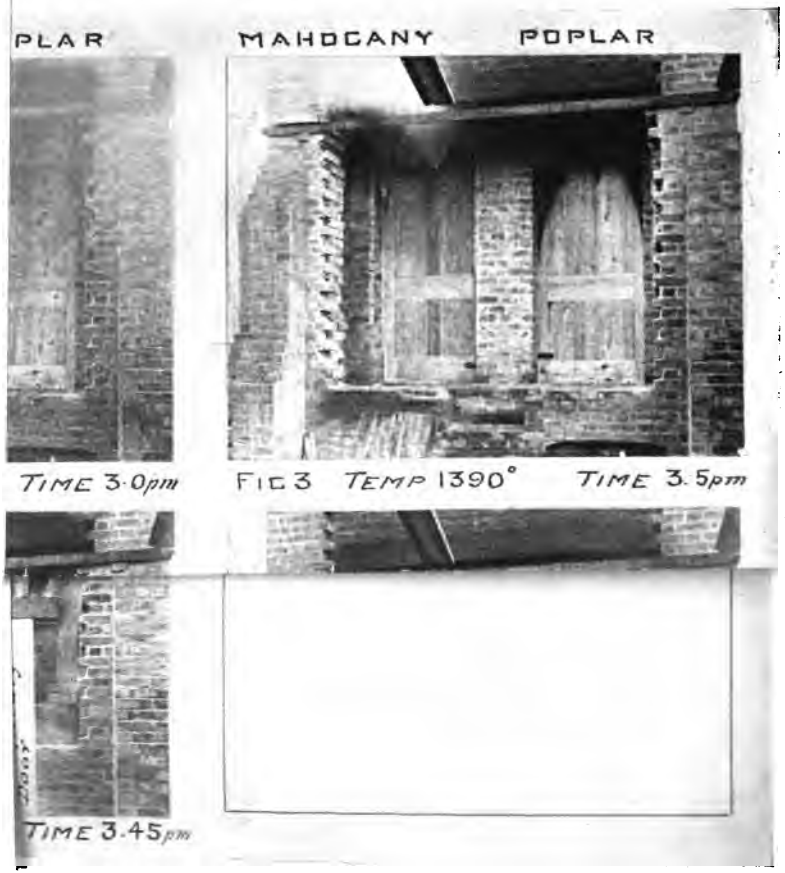

DOORS FROM THE OUTSIDE DURING THE TEST.

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Edited by Edwin O. Sachs.

FIRE TESTS WITH DOORS.

A 2-in. FRAMED HONDURAS MAHOGANY DOOR, WITH 2-in. SOLID PANELS.

A 2-in. FRAMED POPLAR DOOR, WITH 2-in. SOLID PANELS.

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OF

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LONDON, 1900.

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No. 8.—FIRE SERVICE IN FACTORIES, WORKS, &c.
No. 9.—LESSONS FROM FIRE AND PANIC.
No. 10.—HOW TO BUILD "FIRE-PROOF."
No. 11.—THE TESTS WITH UNPROTECTED COLUMNS.
No. 12.—THE EFFECT OF FIRE.
No. 13.—THE TESTING STATION OF THE B.F.P.C.
No. 14.—OFFICIAL FIRE TESTS WITH FLOORS (No. 1).
No. 15.—CONFLAGRATIONS DURING THE LAST TEN YEARS.
No. 16.—EXPERIMENTAL FIRE TESTS WITH FLOORS (A).
No. 17.—THE TALL BUILDING UNDER TEST OF FIRE.
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No. 19.—OFFICIAL FIRE TESTS WITH CEILINGS (No. 2).
No. 20.—OFFICIAL FIRE TESTS WITH GLAZING (No. 3).
No. 21.—EXPERIMENTAL FIRE TESTS WITH FLOORS (C).
No. 22.—EXPERIMENTAL FIRE TESTS WITH PARTITIONS (D & E).
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No. 24.—EXPERIMENTAL FIRE TESTS WITH DOORS (G, H, AND I).
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No. 26.—EXPERIMENTAL FIRE TESTS WITH DOORS (M AND N).
No. 27.—OFFICIAL FIRE TESTS WITH PARTITIONS (No. 7).
No. 28.—OFFICIAL FIRE TESTS WITH CEILINGS (No. 8).
No. 29.—OFFICIAL FIRE TESTS WITH GLASS (No. 5).
No. 30.—OFFICIAL FIRE TESTS WITH GLASS (N. 6).
No. 31.—OFFICIAL FIRE TESTS WITH GLASS (No. 11).
No. 32.—OFFICIAL FIRE TESTS WITH GLASS (No. 12).
No. 33.—EXPERIMENTAL PLAIN GLASS TESTS (O, P, AND Q).
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No. 35.—EXPERIMENTAL FIRE TESTS WITH DOORS (S AND T).
No. 36.—OFFICIAL FIRE TESTS WITH TREATED WOOD (No. 9)

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To bring together those scientifically interested in the subject of Fire Prevention.

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To establish a reading-room, library and collections for purposes of research, and for supplying recent and authentic information on the subject of Fire Prevention.

To publish from time to time papers specially prepared for the Committee, together with records, extracts, and translations.

To undertake such independent investigations and tests of materials, methods and appliances as may be considered advisable.

The Committee's Reports on Tests with Materials, Methods of Construction, or Appliances are intended solely to state bare facts and occurrences, with tables, diagrams, or illustrations, and they are on no account to be read as expressions of opinion, criticisms, or comparisons.

NOTE.

The report herewith put forward by the Executive refers to the series of experimental fire tests with doors, already dealt with in several publications. The doors here reported on are of Honduras mahogany and of poplar respectively, the size and construction of the doors being identical with the deal and pitch-pine, teak and American oak doors, which have already been under investigation.

EDWIN O. SACHS.

January 5th, 1900.

THE GENERAL ARRANGEMENTS FOR TESTS.

(*MEMORANDUM.*)

The purpose of the tests undertaken by the British Fire Prevention Committee is to obtain reliable data as to the exact fire-resistance of the various materials, systems of construction, or appliances used in building practice.

The tests are of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability is assured, records being mostly taken automatically or by photography, and the temperatures being easily regulated by the application of gas.

All reports on tests solely state the bare facts and occurrences, with tables, diagrams and illustrations, and on no account are reports to include expressions of opinion, nor should any expression be read as a comparison or criticism.

The general arrangement and direction of the tests are in the hands of the Executive, who act in accordance with certain principles laid down after careful study and experiment. The official tests are attended by the members of the Council and the members of the Committee in rotation.

As to the Testing Station, it comprises two houses standing in their own grounds near Regent's Park, and backing on to the Regent's Canal. The principal building is used for Committee Rooms and laboratory purposes, whilst the gardens are utilised for so-called "full-size" tests.

As to the financial aspect of the station, the establishment expenses are being met by a special subscription. As far as the funds of the Committee permit, investigations and experimental tests with ordinary (*i.e.*, not patented) forms of construction are undertaken from time to time and duly reported on. Official tests with patented materials, makers' systems, etc., etc., are subject to a scale of charges, but these charges are so figured as to only just cover the actual cost. Any surplus is refunded. The Testing Station is also open to members for such private research work or tests they may desire to undertake.

The services of the members participating in the management of the station, conducting or attending tests, are given entirely gratuitously.

For the Executive,

EDWIN O. SACHS, *Chairman.*

EXPERIMENTAL FIRE TESTS

CONDUCTED BY THE EXECUTIVE

OF THE

British Fire Prevention Committee.

[FOUNDED 1897.—INCORPORATED 1899].

FIRE TESTS, V AND W, NOV. 1ST, 1899.

(V.)—A 2-in. Framed Honduras Mahogany Door with 2-in. Solid Panels.

(W.)—A 2-in. Framed Poplar Door with 2-in. Solid Panels.

OBJECT OF TEST.

To record the effect of a fierce fire of one hour, gradually increasing to a temperature of 2,000° Fahr.

Note.—The fire was to be applied from one side, and the doors were to open inwards on to the fire side.

Note.—The door-openings were to be approximately 3 ft. 3 in. by 6 ft. 9 in.

SUMMARY OF EFFECT.

MAHOGANY DOOR.

In 15 minutes a slight spurt of flame appeared between frame and top of door and then ceased.

In 26 minutes the above flame became continuous all along top rail of door.

In 42 minutes flame appeared through the joints of the four outer corners of lower panels and bottom outside corners of upper panels.

In 49 minutes door fell inwards, all bolts and hinges being red hot, and becoming detached from the door.

POPLAR DOOR.

In 1 minute smoke came through joint between head of door and frame, the joint being $\frac{1}{4}$ in. wide.

In 5 minutes flame through the above-mentioned joint became continuous.

In 10 minutes the door was very much twisted and flame came through joint at top and part way down sides.

In 24 minutes the top west panel fell in.

In 36 minutes the whole door had collapsed and fallen inwards.

DESCRIPTION OF TESTING PLANT.

(*See Figs.* A, B, C *and* D).

The Testing Chamber used was located at the Committee's Testing Station, and was known as No. 2 Hut.

The hut was constructed, as shown, of stock bricks with lime mortar, and measured 10 ft. by 10 ft. internally. The ceiling of the hut was 9 ft. 6 in. above the pavement of the chamber, and was formed of solid wood beams grouted with fire-clay. The chamber in which the fire was measured 10 ft. by 7 ft. 10 in.

The fuel used was gas produced at the station, and the supply was regulated by valves and dampers.

The gas was admitted through two mixing chambers of fire-brick, as shown.

Two Roberts-Austen pyrometers were used for recording temperatures, to take four observation records from points Nos. 1, 2, 3, 4; points Nos. 2 and 3 being outside the doors and the others on the fire side of doors. A continuous record was also taken from point No. 5.

There were observation holes in the east and west walls, closed by movable iron shutters.

The draught holes were in the east and west walls.

The photographs were partly taken by daylight and partly by flash-light.

A brick wall 14 in. thick, with two openings 3 ft. 3 in. wide, 7 ft. high, was built across the hut, running from

POPLAR DOOR. MAHOGANY DOOR.

Figs. E, F. DETAILS OF DOORS.

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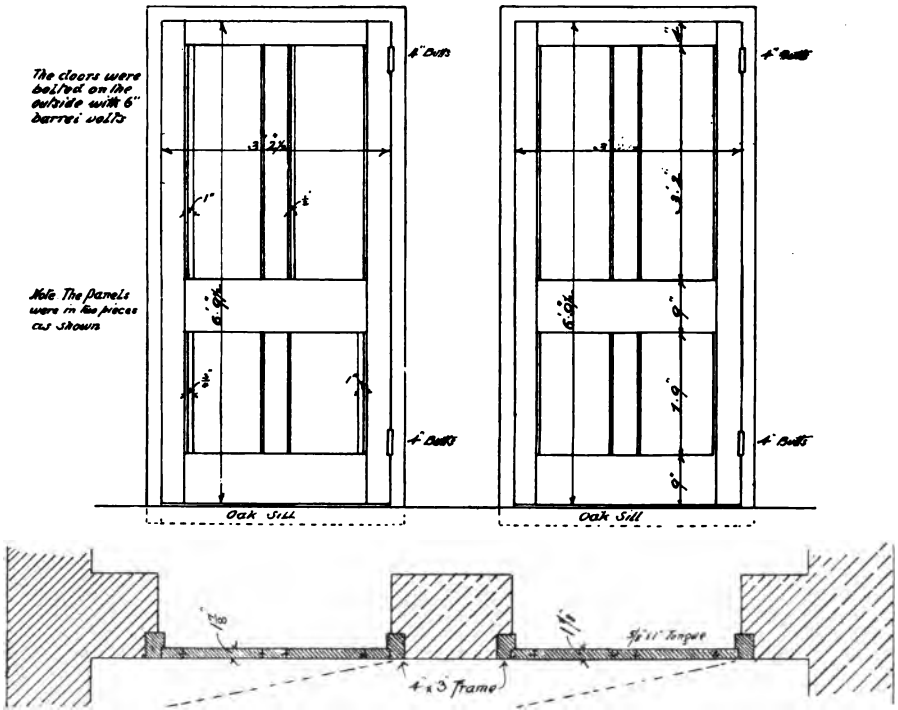


POPLAR DOOR. MAHOGANY DOOR.

Figs. E, F. DETAILS OF DOORS.

east to west. It was built 13 in. back from the main wall. The wall was carried up to the ceiling, the height between floor and ceiling being 9 ft. 6 in. The two openings were arched over with brick arches in two half-brick rings. The wall was built with gauged stuff.

CONSTRUCTION OF THE DOORS.

THE MAHOGANY DOOR.

(*See Figs.* E *to* G).

The door was of Honduras mahogany, 2 in. thick, which measured $1\frac{7}{8}$ in. when finished, 4 panels, bead butt both sides, the panels being solid $1\frac{7}{8}$ in. thick, and tongued to styles and rails with 1 in. by $\frac{5}{8}$ in. oak tongues.

The styles and top rail were 5 in. wide; the centre and bottom rails were 9 in. wide.

The door was hung with 1 pair of 4-in. wrought iron butts, and fastened with two 6-in. iron neck bolts, fixed on outside of door.

The frame was of Honduras mahogany, 4 in. by 3 in. with $\frac{1}{2}$ in. rebate, and was secured to the brick reveal with deal plugs.

THE POPLAR DOOR.

The door and frame were of Poplar, and was similarly constructed and hung, except that the panels were jointed up. These joints were not tongued.

The door did not fit the frame closely, and was slightly twisted.

Note.—The doors and frames were fixed in the hut on October 30th. The mahogany door was on the east side, and the poplar door on the west side. All joints against brickwork were stopped with fire-clay.

The doors stood 12 in. above floor of hut.

PREPARATIONS FOR TEST.

On the afternoon of November 1st photographs were taken of the two doors from the outside. (See Fig. G).

THE TEST.

(*See Figs.* 1 *to* 12, *and* H *to* M).

On Wednesday, November 1st, the test was undertaken. The following is the log of the test :—

At 3 p.m. the meteorological observations taken at the Botanic Gardens, Regent's Park, read as follows:— "State of weather, clear, fine; Rain, none; Wind, S.; Barometer, 29·78 in.; Attached Thermometer, 50° Fahr.; Dry bulb, 58·8° Fahr.; Wet bulb, 46·5° Fahr.

The following temperature observations were taken during the test from points Nos. 1, 2, 3 and 4.

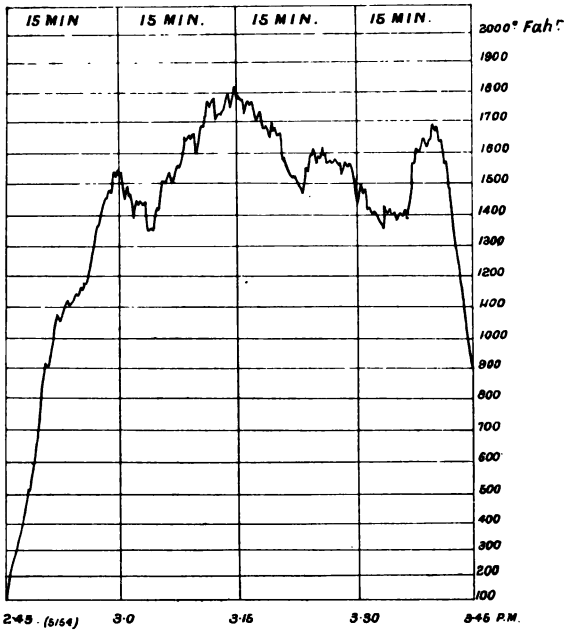
OBSERVATIONS TAKEN AT POINTS, 1, 2, 3 AND 4.

(*From* 2.50 *p.m. to* 3.33 *p.m.*)

	Inside.		Outside.	
Time.	No. 1 Fahr.	No. 4 Fahr.	No. 2 Fahr.	No. 3 Pahr.
2.50 p.m.	225°	225°	—	—
2.53 ,,	810°	850°	—	—
2.56 ,,	1200°	1120°	—	200°
2.59 ,,	1275°	1200°	—	380°
3.2 ,,	1530°	1400°	—	745°
3.5 ,,	1450°	1320°	—	630°
3.8 ,,	1510°	1390°	—	715°
3.11 ,,	1605°	1475°*	100°	1090°
3.14 ,,	1680°	1560°	260°	920°
3.17 ,,	1700°	1590°	530°	1335°
3.20 ,,	1610°	1550°	450°	1285°
3.23 ,,	1530°	1510°	495°	1260°
3.26 ,,	1430°	1545°	300°	1315°
3.29 ,,	1350°	1400°	425°	1050°
3.32 ,,	1495°	1545°	550°	1300°
3.35 ,,	1600°	1625°	800°	1100°

* Wires alight.

AUTOMATIC RECORD AT POINT NO. 5.



THE TEST (*continued*).

MAHOGANY DOOR.

At 2.50 p.m. the gas was lighted.

Observations on Outside.

POPLAR DOOR.

At 2.50 p.m. the gas was lighted.

Observations on Outside.

At 2.51 smoke came through the joint between frame and top rail, the joint being $\frac{1}{4}$ in. wide.

At 2.53 p.m. smoke continued coming through the joint between frame and top rail, also some flame. (See Fig. 1.)

At 2.55 p.m. the above observation was continuous

MAHOGANY DOOR—*continued.*

At 3.5 p.m. very slight spurt of flame coming through joint between frame and top rail of door at west corner.

At 3.16 p.m. flame came through joint between head of door and frame and also

POPLAR DOOR—*continued.*

and also flame coming out about 12 ins. down east style.

At 3.0 p.m. flame came through joint at head of door and about 20 ins. down each side, the upper portion of door being twisted inwards, leaving a space of $\frac{3}{4}$ in. between top of door and frame, the screws fastening bolt being pulled out of the wood.

At 3.7 p.m. bottom rail of door curved inwards in the centre $\frac{1}{2}$ in. at the widest point, and flame was visible down joint between frame and west style. (See Fig. 4.)

At 3.10 p.m. top bolt and top hinge fell off, and the door was leaning 8 ins. inwards.

At 3.14 p.m. top west panel fell in. (See Fig. 5.)

MAHOGANY DOOR—*continued.*

west side of frame and style. Door twisted inwards at top slightly.

At 3.27 p.m. joint between sill and bottom rail burnt all along, leaving an opening of about 1 in., and slight flame coming through the joints between frame and east and west styles at level of middle rail. (See Fig. 8.)

At 3.28 p.m. top bolt and plate red hot and top of door twisted inwards ½ in.

At 3.31 p.m. half of top rail, east side, fell inwards. (See Fig. 9.)

At 3.32 p.m. flame appeared at the four outer corners of the lower panels and bottom outside corners of upper panels, also at one point between lower muntin and east panel.

At 3.35 p.m. top of door twisted inwards, leaving a space of 1 in. between door and frame (See Fig. 9.)

At 3.39 p.m. door fell inwards. (See Fig. 10.)

POPLAR DOOR—*continued.*

At 3.26 p.m. the last portion of door fell inwards. (See Fig. 8.)

Note.—At 3.33 p.m. temporary sheathed door put up to cover the opening where door was. (See Fig. 9.)

MAHOGANY DOOR—*continued.*

Observations on Inside.

At 2.56 p.m. the door burning slightly all over and slightly at the joint between door and frame.

At 3.10 p.m. door burning all over surface and flaking.

POPLAR DOOR—*continued.*

Observations on Inside.

At 2.56 p.m. the joint between door and frame was burning all round very freely and the door was slightly burning all over surface.

At 3.10 p.m. door burning all over surface and flaking.

Fig. H. View showing condition of Doors after 25 Minutes.

MAHOGANY DOOR. POPLAR DOOR.

Fig. 1. VIEW SHOWING CONDITION OF DOORS AFTER 35 MINUTES.

MAHOGANY DOOR. POPLAR DOOR.

Fig. K. VIEW SHOWING CONDITION OF DOORS AFTER 40 MINUTES.

Fig. L. VIEW SHOWING CONDITION OF MAHOGANY DOOR AFTER 45 MINUTES.

MAHOGANY DOOR. TEMPORARY DOOR.

Fig. M. VIEW SHOWING CONDITION OF MAHOGANY DOOR AFTER 48 MINUTES.

OBSERVATIONS AFTER TEST.

MAHOGANY DOOR.

After the test the frame was seen to have been burnt very considerably, but no portion of it was burnt completely through or fallen.

POPLAR DOOR.

After the test the temporary door was taken down, and all the frame was seen to have been burnt, and all had fallen except a small portion of the head.

GENERAL ARRANGEMENTS.

The test was carried out as an experimental test in accordance with the procedure laid down by the Executive for investigations of this description, and conducted by a Sub-Committee of the Executive, comprising:—

Mr. Max Clarke, A.R.I.B.A. (Directing Member).
Mr. Ellis Marsland, District Surveyor, Camberwell.
Mr. George Monckton, M.A.

Mr. Thomas Kissack, Resident Engineer at the Testing Station, assisted the Sub-Committee.

Mr. H. B. White, M.I.E.E., superintended the instrument room.

The Executive was represented by:—

Mr. Edwin O. Sachs (Chairman).
Mr. F. Hammond, District Surveyor, Hampstead.
Mr. Robert Mond.

The Commercial Section was represented by:—

Mr. Fred. R. Farrow, F.R.I.B.A.

Signed,

For the Sub-Committee conducting the Test:
MAX CLARKE.

For the Commercial Section:
FREDERIC R. FARROW.

For the Executive:
EDWIN O. SACHS.

Published by the Committee as directed by the Executive.
GEORGE E. MONCKTON
(*Secretary*).
Date—January 1st, 1900.

FIG 1 TEMP 1075° TIME 2.45pm

FIG 2 TEM.

FIG 5 TEMP 1590° TIME 3.5pm.

FIG 6 TE.

FIG 9 TEMP 1450° TIME 3.25pm

FIG 10 TA

Publications of the
BRITISH FIRE PREVENTION COMMITTEE.—No. 40.
Edited by Edwin O. Sachs.

FIRE TESTS WITH DOORS.

A 2-in. FRAMED AUSTRIAN OAK DOOR, WITH 2-in. SOLID PANELS.

A 2-in. FRAMED AMERICAN WALNUT DOOR, WITH 2-in SOLID PANELS.

Particulars
OF
EXPERIMENTAL FIRE TESTS.

ALL RIGHTS RESERVED.

LONDON, 1900.

PUBLISHED AT THE OFFICES OF
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(Founded, 1897—Incorporated, 1899),
1, WATERLOO PLACE, PALL MALL.

Two Shillings and Sixpence.

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No. 25.—EXPERIMENTAL FIRE TESTS WITH DOORS (K AND L).
No. 26.—EXPERIMENTAL FIRE TESTS WITH DOORS (M AND N).
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No. 31.—OFFICIAL FIRE TESTS WITH GLASS (No. 11).
No. 32.—OFFICIAL FIRE TESTS WITH GLASS (No. 12).
No. 33.—EXPERIMENTAL PLAIN GLASS TESTS (O, P, AND Q).
No. 34.—EXPERIMENTAL FIRE TESTS WITH FLOORS (R).
No. 35.—EXPERIMENTAL FIRE TESTS WITH DOORS (S AND T).
No. 36.—OFFICIAL FIRE TESTS WITH TREATED WOOD (No. 9).

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NOTE.

Again a report is presented dealing with doors, the materials used in this case being Austrian oak and American walnut respectively.

This report should of course be studied in connection with those dealing with similar door tests, and particularly with the one embodied in Publication No. 26, where the materials used were American oak and Moulmein teak.

EDWIN O. SACHS.

March 2nd, 1900.

THE GENERAL ARRANGEMENTS FOR TESTS.

(MEMORANDUM.)

The purpose of the tests undertaken by the British Fire Prevention Committee is to obtain reliable data as to the exact fire-resistance of the various materials, systems of construction, or appliances used in building practice.

The tests are of an entirely independent character, arranged on scientific lines, but with full consideration for the practical purpose in view. Absolute reliability is assured, records being mostly taken automatically or by photography, and the temperatures being easily regulated by the application of gas.

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The services of the members participating in the management of the station, conducting or attending tests, are given entirely gratuitously.

For the Executive,

EDWIN O. SACHS, *Chairman.*

EXPERIMENTAL FIRE TESTS

CONDUCTED BY THE EXECUTIVE

OF THE

British Fire Prevention Committee.

[FOUNDED 1897.—INCORPORATED 1899.]

FIRE TESTS, X AND Y, NOV. 15TH, 1899.

X.—A 2-in Framed Austrian Oak Door, with 2-in. Solid Panels.

Y,—A 2-in. Framed American Walnut Door, with 2-in. Solid Panels.

OBJECT OF TEST.

To record the effect of a fierce fire of one hour, gradually increasing to a temperature of 2,000° Fahr.

Note.—The fire was to be applied from one side, and the doors were to open inwards on to the fire side.

Note.—The door openings were to be approximately 3 ft. 3 in. by 6 ft. 9 in.

SUMMARY OF EFFECT.

OAK DOOR.

In 33 minutes flame appeared through top of east top panel, between rail and panel.

In 45 minutes lower west panel fell out.

In 51 minutes upper panels and muntin and top rail fell out.

In 55 minutes remaining portion of door collapsed.

WALNUT DOOR.

In 15 minutes flame appeared at intervals over top rail, west side.

In 36 minutes flame between joint top west panel and top rail.

In 42 minutes flame through joint between top muntin and upper east panel.

In 58 minutes door collapsed.

DESCRIPTION OF TESTING PLANT.

(See Figs. A, B, C *and* D*).*

The Testing Chamber used was located at the Committee's Testing Station, and was known as No. 2 Hut.

The chamber was constructed, as shown, of stock bricks, with lime mortar, and measured 10 ft. by 10 ft. internally. The ceiling of the hut was 9 ft. 6 in. above the pavement of the chamber, and was formed of solid wood beams grouted with fire clay.

The fuel used was gas produced at the station, and the supply was regulated by valves and dampers.

The gas was admitted through two mixing chambers of fire-brick, as shown.

Two Roberts-Austen pyrometers were used for recording temperatures, to take four observation records from points Nos. 1, 2, 3, 4; points 2 and 3 being outside the door, and the others on the fire side of doors. A continuous record was also taken from point No. 5.

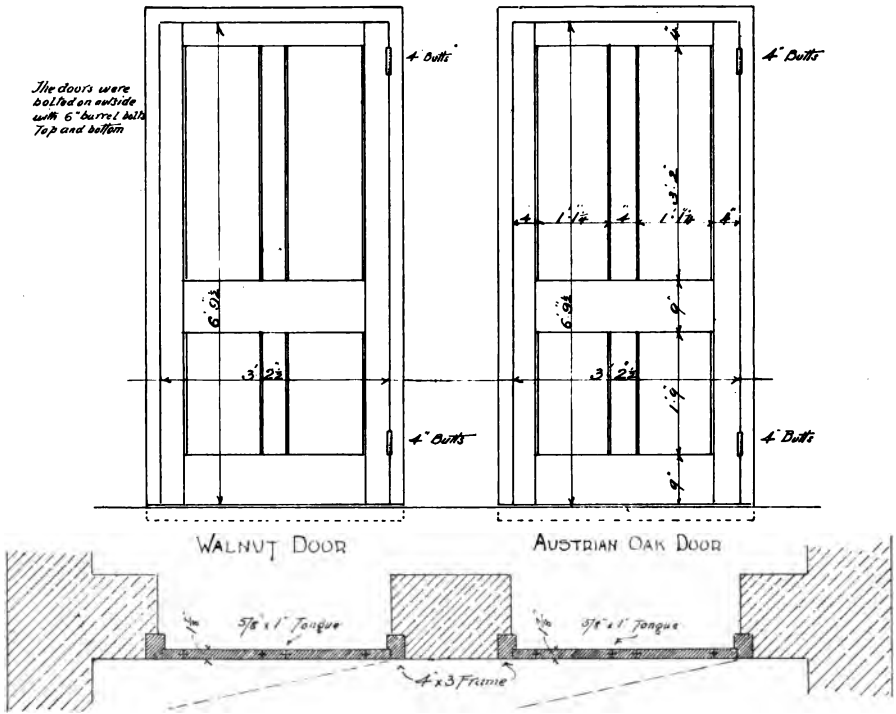
There were observation holes in the east and west walls, closed by moveable iron shutters.

The draught holes were in the east and west walls.

The photographs were partly taken by daylight and partly by flash-light.

A brick wall 14 in. thick, with two openings 3 ft. 3 in. wide, 7 ft. high, was built across the hut, running from east to west. It was built 15 in. back from the main

DETAILS OF DOORS. *Figs.* E *and* F.



DETAILS OF DOORS. *Figs.* E *and* F.

wall. The wall was carried up to the ceiling, the height between floor and ceiling being 9 ft. 6 in. The two openings were arched over with brick arches in two half-brick rings. The wall was built with gauged stuff.

CONSTRUCTION OF THE DOORS.

THE OAK DOOR.

(See Figs. E *and* F.*)*

The door was of Austrian oak, 2 in. thick, which measured $1\frac{7}{8}$ in. when finished, 4 panels, bead butt both sides, the panels being solid $1\frac{7}{8}$ in. thick, and tongued to styles and rails with 1 in. by $\frac{5}{8}$ in. oak tongues.

The styles and top rail were 5 in. wide, the centre and bottom rails were 9 in. wide.

The door was hung with one pair of 4 in. wrought iron butts, and fastened with two 6 in. iron neck bolts, fixed on outside of door.

The frame was of Austrian oak, 4 in. by 3 in. with $\frac{1}{2}$ in. rebate and was secured to brick reveal with deal plugs.

THE WALNUT DOOR.

The door was of American walnut, and was constructed and hung as the oak door.

Note.—The doors and frames were fixed in the hut on July 4th. The oak door on the east side, and the walnut door on the west side. All joints against brickwork were stopped with mortar.

The doors stood 12 in. above floor of hut.

PREPARATION FOR TEST.

On the afternoon of November 15th photographs were taken of the two doors from the outside. (See Fig. G.)

THE TEST.

(*See Figs.* 1 *to* 12, *and* H *to* M).

On November 15th the test was undertaken. The following is the log of the test.

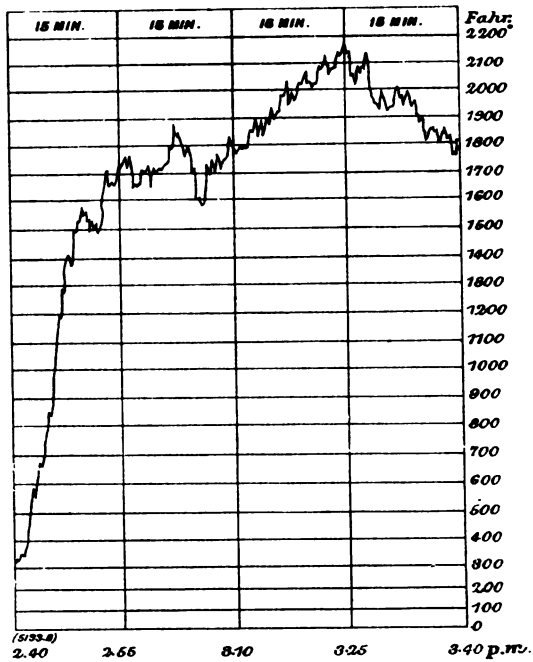
At 3 p.m. the meteorological observations taken at the Botanic Gardens, Regent's Park, read as follows:— "State of weather, overcast; Wind, E.N.E.; Barometer, 30·52 ins.; Attached Thermometer, 50° Fahr.; Dry bulb, 50° Fahr.; Wet bulb, 47·8° Fahr. Remarks: fine afternoon, but dull."

The following temperature observations were taken during the test from points Nos. 1, 2, 3 and 4.

OBSERVATIONS TAKEN AT POINTS 1, 2, 3, 4.

(*From* 2.41 *p.m. to* 3.41 *p.m.*)

	INSIDE.		OUTSIDE.	
TIME.	NO. 1 Fahr.	NO. 4 Fahr.	NO. 2 Fahr.	NO. 3 Fahr.
2.41 p.m.	400°	400°	—	—
2.44 ,,	780°	775°	—	—
2.47 ,,	1,400°	1,350°	—	—
2.50 ,,	1,500°	1,450°	—	—
2.53 ,,	1,600°	1,550°	—	—
2.56 ,,	1,620°	1,510°	—	—
2.59 ,,	1,700°	1,650°	—	—
3.2 ,,	1,640°	1,530°	—	—
3.5 ,,	1,550°	1,630°	—	—
3.8 ,,	1,680°	1,740°	100°	110°
3.11 ,,	1,750°	1,740°	100°	145°
3.14 ,,	1,840°	1,810°	120°	190°
3.17 ,,	1,905°	1,860°	200°	240°
3.20 ,,	1,960°	1,880°	210°	375°
3.23 ,,	2,000°	750°	300°	620°
3.26 ,,	1,950°	1,100°	410°	830°
3.29 ,,	1,800°	1,000°	910°	1,100°
3.32 ,,	1,730°	1,700°	1,075°	1,050°
3.35 ,,	1,700°	950°	1,050°	1,100°
3.38 ,,	1,730°	1,000°	1,100°	1,135°
3.41 ,,	1,620°	875°	1,100°	1,200°



THE TEST *continued.*

AUSTRIAN OAK DOOR.

Observations on Outside.

At 2.40 p.m. the gas was lighted.

At 2.44 p.m. smoke over top rail.

AMERICAN WALNUT DOOR.

Observations on Outside.

At 2.40 p m. the gas was lighted.

At 2.44 p.m. smoke over top rail at west corner by top bolt.

At 2.45 p.m. smoke over top rail spreading along top edge.

At 2.54 p.m. slight smoke issuing between joint of frame and style, west side, by lower bolt.

AUSTRIAN OAK DOOR—*continued.*

At 2.58 p.m. smoke coming through joint between lock rail and style, east side.

At 3.2 p.m. smoke coming through joint between lock rail and style, west side. Resin running down door.

At 3.7 p.m. smoke coming through joint between door and frame by lower bolt, west side.

3.11 p.m. upper panels bulging outwards at bottom.

At 3.13 p.m. flame through top of east top panel between rail and panel.

At 3.15 p.m. centre top muntin at bottom and lower edges of top panels bulging outwards to the extent of $\frac{3}{4}$ inch.

AMERICAN WALNUT DOOR—*continued.*

At 2.55 p.m. flame at intervals over top rail, west side, by top bolt.

At 2.57 p.m. slight smoke at lower corner of top panel, by style, west side.

At 2.58 p.m. flame increasing along top rail.

At 3 p.m. flame extending down style, west side.

At 3.11 p.m. upper panels, east side, bulging out at bottom, also the upper muntin at the same point.

At 3.16 p.m. flame between joint of top west panel and top rail.

AUSTRIAN OAK DOOR—*continued.*

At 3.23 p.m. the bulging of centre top muntin increasing.

At 3.25 p.m. lower west panel fell out.

At 3.31 p.m. upper panels and muntin and top rail fell out.

At 3.35 p.m. remaining portion of door fell.

Observations on Inside.

At 2.43 p.m. door began to flame on surface.

At 2.46 p.m. door blazing freely all over, and surface cracks in the charred wood very marked.

At 3.8 p.m. flakes of charred wood began to fall off the centre rail.

At 3.24 p.m. all surface of door and inside of hut so full of flame could see nothing to record.

AMERICAN WALNUT DOOR—*continued.*

At 3.22 p.m. flame through joint between top muntin and upper east panel.

At 3.38 p.m. door collapsed.

Observations on Inside.

At 2.44 p.m. door began to flame at top on the surface.

At 2.46 p.m. door blazing freely all over the surface.

At 3.8 p.m. door blazing freely all over, but no charred wood fallen.

At 3.24 p.m. all surface of door and inside of hut so full of flame, could see nothing to record.

Fig. H.—VIEW SHOWING CONDITION OF DOORS AFTER 35 MINUTES.

Fig. 1.—View showing Condition of Doors after 40 Minutes.

Fig. K.—View showing Condition of Doors after 43 Minutes.

OAK DOOR. WALNUT DOOR.

Fig. 1.—VIEW SHOWING CONDITION OF DOORS AFTER 45 MINUTES.

Oak Door. Walnut Door.

Fig. M.—View showing Condition of Doors after 55 Minutes.

OBSERVATIONS AFTER TEST.

AUSTRIAN OAK DOOR.

At 4 p.m., November 15th, the frame was still in position, no portion having fallen, the top west angle being burned right through, the remainder of the frame was charred, very much at the head and upper portion of posts, getting less towards foot of posts.

AMERICAN WALNUT DOOR.

At 4 p.m. November 15th, the frame was still in position, no portion having fallen, the top West angle being burned through, the remainder of the frame was charred, very much at the head and upper portion of posts, getting less towards foot of posts.

GENERAL ARRANGEMENTS.

The test was carried out in accordance with the procedure laid down by the Executive for investigations of this description, and conducted by a Sub-Committee of the Executive, comprising :—

Mr. Max Clarke, A.R.I.B.A. (Directing Member).
Mr. Ellis Marsland, District Surveyor, Camberwell.
Mr. R. Mond, M.A., F.R.S.E.

Mr. Thomas Kissack (Resident Engineer at the Testing Station) assisted the Sub-Committee.

Mr. H. B. White, M.I.C.E., superintended in the Instrument Room.

The Council was represented by :-

Mr. Arthur Cates, late Surveyor, Crown Estates.
Mr. H. Gundry, F.R.I.B.A., President District Surveyors' Association.

The Executive was represented by :—

Mr. Edwin O. Sachs (Chairman).
Mr. Chas. E. Goad, M.Am.Soc.C.E.
Mr. F. Hammond, F.R.I.B.A., District Surveyor, East Hampstead.

The Commercial Section was represented by :—

Mr. Frederic R. Farrow, F.R.I.B.A.

The Members' Testing Sub-Committee was represented by :—

Mr. George E. Monckton, M.A.

The general body of Members was represented by :—

Mr. C. F. Hayward, F.S.A., F.R.I.B.A., District Surveyor, Bloomsbury.

Mr. E. R. Hewitt, A.R.I.B.A., District Surveyor, Southwark.

Mr. Lowe, F.S.A., Vestry Surveyor, Hampstead.

Mr. G. McDonnell, A.R.I.B.A., District Surveyor, St. Lukes.

Mr. S. F. Monier-Williams, District Surveyor, Fulham (South).

Mr. R. P. Notley, F.R.I.B.A., F.S.I., District Surveyor, Bethnal Green.

Mr. J. R. Manning, M.S.A.

Mr. L. E. Aulagnier.

Mr. J. Buley.

Mr. H. Busbridge.

Mr. J. Tolley.

Mr. W. Waine.

Mr. T. Wilkins, F.G.S.

The following visitors attended by special invitation of the Executive :—

Herr Muthesius, Technical Attaché to the German Embassy.

Monsieur le Capitaine Welsch, Commandant des Sapeurs-Pompiers, Ghent.

Mr. T. Sims, Admiralty.

Mr. Sydney R. J. Smith, F.R.I.B.A., F.S.I.

Mr. J. Howard Colls.

Mr. C. A. Balph.

Mr. J. D. O'Brien.

Mr. W. J. Delbridge.
Mr. J. F. Golding.
Mr. Herbst.
Major J. de C. Helbert.
Mr. Edmond Kelly.
Mr. W. Markham.
Mr. E. C. Pilkington.
Mr. E. Thurnysen.

Signed,

For the Sub-Committee conducting the Test:
MAX CLARKE.

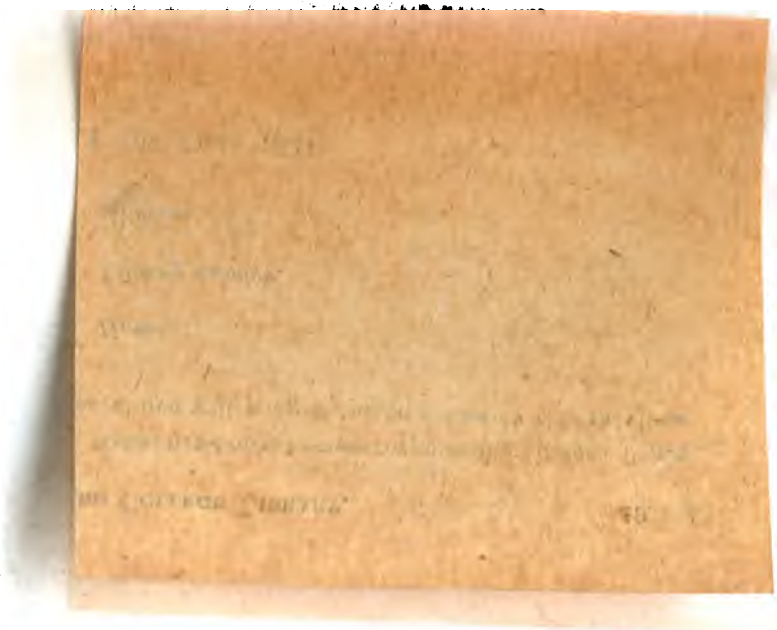
For the Commercial Section:
FREDERIC R. FARROW.

For the Executive:
EDWIN O. SACHS.

Published by the Committee as directed by the Executive.

H. S. TAYLOR
(Assistant Secretary).

Date—March 1st, 1900.



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